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PSYCHOLOGY AND EDUCATION

BY

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TO
KURT KOFFKA

PREFACE

In dedicating this book to Professor Kurt Koffka of the University of Giessen, I am expressing not only the homage of a friend and admirer but also my indebtedness for much that has gone into its making. In the teaching of educational psychology, which has been my chief concern during the past nine years, I have found myself out of sympathy with the "mechanism" which has supplied the laws and principles of many current pedagogical doctrines. But I have been equally averse to "purpose" as the keynote of mental and bodily behavior. The search for a truly functional concept which I could adopt as the basic principle of behavior was not rewarded until I read Koffka's *Grundlagen der Psychischen Entwicklung* (1921). My translation of this book, entitled *The Growth of the Mind* (1924), afforded me an opportunity to become intimately acquainted with the point of view of *Gestalt* psychology, and its application to child study. So readily did I find my way under this new guidance, that the materials of my introductory course at Cornell University seemed to shape themselves without effort into a systematic form, and problems in educational psychology, such as that of explaining how we learn a new act, seemed to clarify themselves at once. After re-reading some of my earlier publications, I am tempted to believe that this process of orientation was, indeed, a natural one on my part, and that the notion of *Gestalt* was implicit in

my own thought long before it became explicit through the reading of Koffka, Wertheimer, and Köhler.

However that may be, my debt to Koffka in particular is very great, and I freely confess that much of the material in the present volume is to be found in his *Grundlagen*. But my debt to him is not limited to his book alone. The fortunate and agreeable experience of having him as a colleague at Cornell University during the academic year 1924–25 made possible a personal contact from which I have greatly benefited. In the give-and-take of informal discussion, many problems were carried further on their way to a solution. The first half of my book, already in manuscript, was read and criticized by him, as was also the entire work in the outline-form of a syllabus which I was using with my classes in lieu of a textbook.

I believe that I have thus been enabled to give for the first time to the study of education a psychological background which commends itself as an orderly and systematic development of scientific principles derived from factual observation rather than from "neurological tautologies." While the careful critic will no doubt discover errors both of omission and commission, these errors, I think, will be found capable of correction without altering the fundamental principles upon which the treatment of the subject has been based. So many are the supporting bits of evidence from other sciences, both biological and physical, that I am loath to believe that the genetic point of view I have adopted can be easily overturned by any revolutionary method of approach to the subject.

On the other hand, I fully realize the limitations of the book. Many topics distinctly psychological in nature have for lack of space been omitted, and the development of others has been for the same reason barely indicated. In an effort to deal with the subject in a straightforward and non-controversial manner, I have avoided theoretical discussion wherever I could. This, however, was not always possible; and, in consequence, to the beginning student and to the teacher untrained in psychology, some portions of the book will perhaps prove harder reading than others. To such persons, therefore, I suggest that, on first reading, the following sections may be passed over: 7, 22, 23, 27, 31, 32, 33, 62, 63. Not only do these sections contain theoretical discussions involving some intrinsic difficulty, but they also bear the implications of a philosophy of education which goes beyond the limits of the present work. In the syllabus mentioned above were sketched several additional chapters which carried the discussion of these topics to a greater length. But when I began to prepare the final manuscript for the press, I found that these chapters were ranging too far afield, and that at best their inclusion would be but a sort of philosophical appendix to a work which aimed to be an introduction to the psychology of education. I have therefore reserved these topics for treatment in a companion volume to be entitled *Philosophy and Education.*

In the matter of terminology I have carefully avoided the terms *conscious* and *consciousness,* chiefly in order that I might emphasize the functional aspect of psychology as a key to

behavior, rather than because I have any aversion to these terms in their proper context. I have likewise avoided the term *tendency* on account of its teleological implications. *Attention*, a third source of ambiguity in many psychological writings, I have treated briefly in § 41; otherwise I have found no occasion for employing it. I would defend the use of *pattern*, *form*, *figure*, and *configuration* as equivalents for the German term *Gestalt*. *Configuration*, the more technical of the four, is employed in the latter portion of the book where the implications are phenomenal or experiential. Since applied psychology is always "functional," I have not thought it necessary to bear constantly in mind the possible distinction of "function" and "structure"; consequently, the various terms used for *Gestalt* I have defined by their contexts rather than by formal definitions. I have been much more intent upon describing behavior and its phenomena than upon referring them to terms with supposed magical potencies of explanation. In this connection I am reminded of a remark by Professor Köhler that the word *Gestalt* is taboo in his laboratory at the University of Berlin, and no one is permitted to employ it without at once adding a description of the phenomenon so designated. *Configurationism* is an execrable word, and to employ it as a shibboleth is to do a disservice to an accurate description of facts.

In addition to my debt to Koffka, and to his co-workers, including Köhler and Wertheimer, I desire to acknowledge the valuable criticism of my friend and former colleague, Seth Wakeman, Professor of Education in Smith College,

particularly in the writing of the final chapter on "The Measurement of Intelligence." And last, but not least, I owe a profound debt of gratitude to my friend Professor Joseph Quincy Adams, who read the entire manuscript before printing, and kindly assisted me in the arduous labor of correcting the proofs.

R. M. Ogden.

Ithaca, New York,
March 2, 1926.

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PSYCHOLOGY AND EDUCATION

CHAPTER I

THE EDUCATION OF THE CHILD

§ 1. *The Nature of Childhood*

When a child has exhausted the possibilities of the home environment and begins to show a marked interest in co-operative play with other children, he is thought to be ready for a formal education. Knowing very little of his true inward state of mind, we are inclined to regard him as a "mere child" who has now come along to a stage of development where we can hold him to account for his actions, and force upon him the routine of adult life. Accordingly, we send him to school where he must behave himself and "do what the teacher says."

"What the teacher says" is presumably what he should know for his future good—including a great deal that it would never occur to him to find out for himself. The mysteries of the three R's in particular are not so much revealed and clarified, as they are forced upon him and drilled into him, the assumption being that somehow practice in these black arts will in time bring mastery and comprehension in its wake.

Yet how little we understand child-life if we permit such a view to guide our educational methods! Instead of starting his education when he enters school, the child has already achieved in the first six years of his life far more

than he will, or ever can, achieve thereafter in any similar period of time, or even in the entire remainder of his career. Instead of the assumption that an infant is a groping aimless creature, stumbling here and there upon an appropriate mode of behavior which his environment selects for him, a true insight will show the creative efforts and achievements of infancy to be more tremendous in their effects and more far-reaching in their consequences than anything which later life can accomplish.

To many readers this statement will seem dogmatic; for a contrary view that education is essentially a matter of habit-formation is widespread, and has furnished the basis of many methods of instruction, and many theories of education. The criticism of this view will occupy us later on. At present we shall consider what we know about the kingdom of the child. The idea is not at all a new one; indeed most of the current movements in education have the avowed purpose of liberating the child to follow his own will and intention; yet this laudable undertaking suffers now quite as it did in the hands of the great reformer, Jean Jacques Rousseau, who startled the world in 1762 with the publication of his treatise on education entitled *Émile*. It is one thing to maintain in general terms, as Rousseau did, that "nature is right," and quite another thing to understand how and when and why she is right. Although more than one hundred and sixty years have elapsed since Rousseau turned the thought of educators "back to nature," his doctrine has served to quicken the imagination of edu-

cators without, however, being able to define the facts of child-life and human development. The rise of a science of human nature undoubtedly owes much to this impetus; but we are still at the beginning of a long journey into a mysterious region, for we have yet to discover the precise place of mind in nature.

§ 2. *The Problem of Education*

While it is the aim of this book to avoid controversy, and to give instead as simple and straightforward an account of mind and its education as the limited state of our knowledge will permit, it is impossible to overlook those teachings, already referred to, which find in habit-formation both the method and the end of education. But instead of opposing those views at once with a contrary theory of creative achievement, let us first try to state the problem of education, and then proceed to check all inferences which can be derived from such a statement by whatever facts careful observation of the behavior of children has revealed.

What then is Education?

Education is a social process of change in the behavior of living organisms. This answer, simple as it is, contains several important terms, each of which stands in need of definition. First, education is *social*, for it involves the participation of different individuals. Secondly, it is a process of change—which suggests something more than a mere change in time or place—for the word *process* signifies *progression* in a series of events which are bound to-

gether, and which pass from a beginning to an end, or perhaps in a circuit which fulfills its destiny by turning full circle upon itself. The educative process is no arbitrary change, but a systematic and ordered sequence of events. We do not attribute education to a stone which falls from a precipice into a gorge, even though in so doing it should dash itself to pieces on the rocks below; neither do we think of a stream of water as educating the soil over and through which it passes in its turbulent course, even though it does shape and mold its bed by its flow.

Furthermore, the changes wrought by education are changes of *behavior*. But what do we mean by behavior? A social process is here implied, for the term suggests the manner of conducting oneself, and the treatment one accords to others. Even when used for things instead of persons, as when we speak of the behavior of a machine or of a chemical, it is action directed from within rather than from without which warrants our use of the term. Thus we seem to feel a human or a personal touch in the behavior of the thing—something like a personal quality, such as demeanor, deportment, or conduct.

This brings us to the last term of our definition: *living organisms*. Personality belongs to living organisms, and it is with these that we are concerned in education. Furthermore, we are concerned with organisms, not merely as they live and grow, but as they behave and conduct themselves in accordance with the conditions of living and growing. Thus the "process of change" which is a proper subject

for physics and mathematics, is, in the specific instance of education, a change of behavior made in a living organism which not only lives but feels, and perhaps reflects.

It thus appears that our simple definition is not simple after all; for it leads us into four great fields of science—Physics, Biology, Psychology, and Sociology—and into Philosophy. Many of our data and much of our method must be borrowed from these sources. But it will be best to state our problem concretely, and borrow as our needs are felt, rather than try to survey the relevant sciences and present a philosophy of life at the outset of our inquiry. Everyone knows that physics deals with mass and motion; and that a child or an adult man has both. Everyone knows, too, that the subject of education is a living creature having biological, psychological, and sociological aspects. With this knowledge we can let the creature tell its own story by its concrete behavior, without trying to trace each aspect of this behavior back to its scientific or philosophical source.

Beginning, then, with the quaintly inadequate little creature who comes into the world untaught and uninformed, what can we make of a baby's first days of life? Aimless as his movements appear to be, and dependent as he is upon the guiding care of mother and nurse, a closer scrutiny reveals certain ways that are original to himself. His eyes will blink; and though they sometimes wander in different directions, they will converge and "fixate" a bright point of light shown in a darkened room. More-

over, when his hands come in contact with a seizable object, his fingers will grip it so rigidly that he can thereby be raised from the ground and suspended in the air for some time.

§ 3. *Nursing*

Among all original modes of behavior the act of nursing is perhaps the most interesting and the most significant. We may quote the description of this response given by a careful observer, Dr. John B. Watson:

> If either cheek or the chin is touched lightly with the finger, an infant shortly after birth will move the head in such a way as to bring the mouth in contact with the finger. In deep sleep [this behavior] apparently disappears. After feeding it is also very hard to elicit. During hunger it is very easy to elicit, the infant often moving with such surprising quickness that it catches the finger in its mouth. Again, if one taps lightly above or below the corner of the mouth of a sleeping baby the lips are pursed into a nursing position; occasionally the tongue will protrude and complete sucking movements will appear. Children a few hours after birth seem to be able to get the fingers and hands into the mouth. The sucking instinct as a whole seems to be well coördinated by the end of the first half-hour. The series of reflexes as a whole is made up of tongue, lip, and cheek movements, swallowing being the final link in the chain of activities. Although the evidence is not complete as yet, failure in the ability to swallow is suggestive of retardation. Children born of defective parents seem to have difficulty with swallowing.[1]

Let us see what this behavior involves. The first point to be noted is the adjustive movement of the head which

[1] Cf. *Psychology, from the Standpoint of a Behaviorist* (2d. ed.; Philadelphia: Lippincott, 1924), pp. 259 f.

results in bringing the finger, or nipple, to the mouth. This movement is truly adjustive, because it matters not whether cheeks or chin be touched. The second point to be noted is that of differential sensitivity. The adjustment is easy to elicit during hunger, but very hard to elicit after feeding, and apparently it disappears in deep sleep. Obviously, therefore, this is not a response of the head to any touch at any time, but a response appropriate to an internal state of hunger. We have not only a proper adjustment of the head, upwards or downwards, to right or left, according as the touch is on lips or chin, left or right cheek, but also a variation of the response with the internal organic conditions of hunger and satiety.

Nor is that all, for we have not yet referred to the third and most significant aspect of the behavior, namely the act which follows the introduction of finger or nipple into the mouth. I say "follows," yet it would be inaccurate to regard sucking as an act aroused only in succession to the introduction of the finger or nipple into the mouth; for Watson tells us that "if one taps lightly above or below the corner of the mouth of a sleeping baby the lips are pursed into a nursing position; occasionally the tongue will protrude and complete sucking movements will appear." This interesting observation reveals the complex unity of the whole performance. Although we can analyze the behavior, as we have done, and make separate note of the head movements of adjustment, the differential sensitivity arising from conditions of hunger and satiety, and the

complicated series of movements involving tongue, lips, and cheeks which eventuates in swallowing, these elements of the behavior are bound together, not as an invariable series, with one act following upon another, but as a *total dynamic pattern*, the precise details of which vary according to the nature of the conditions under which the action takes place.

The importance of this fact cannot be overemphasized, because a right understanding of sucking—which "as a whole seems to be well coördinated by the end of the first half-hour," as Watson's observations attest—will furnish us a formula of behavior with which the mysteries of the educative process can be solved, and without which we must continue to grope blindly for our explanations, and trust as best we can to the crude and wasteful methods of "trial and error."

We have already recorded Watson's observation that head-movements which bring an object to the mouth are appropriately made from the beginning; other observations have shown that the act of sucking varies in order to meet the conditions of the movement. The lips, as Koffka notes, "must surround the nipple so as to exclude air, and the movements of sucking must take place with a rhythm of the contracting and expanding muscles which is in time with the movements of swallowing." [1] Nor is the movement once begun continued indefinitely or until fa-

[1] Kurt Koffka, *The Growth of the Mind* (New York: Harcourt, Brace, 1924), p. 85.

tigue sets in, for just as hunger conditions the inception of sucking, so satiety brings cessation; when the infant has had enough, he refuses the breast, and will no longer suck even if the nipple is again placed in his mouth. Furthermore, the object itself must be of the right sort, neither too large nor too small, too hot nor too cold, too bitter nor too salty. The nature of the fluid may also influence the behavior; Preyer [1] observed in the case of his own infant that thinned cow's milk was refused on the fourth day until it had been sweetened, although on the second day the infant took this nourishment from a bottle without objection. Apparently the infant's discrimination had improved between the second and fourth day after birth; and this improvement shows an educative influence. Despite the remarkable completeness of suckling at birth, the coordination of the movements improves with practice, while the selective function depending upon the conditions of arousal and the inner states of the organism begin at once to reveal those changes which characterize the educative process.

That an original act like nursing reveals germs of the educative process is best shown, perhaps, by a comparison of the behavior of normal infants with the behavior of defectives. Sollier, for instance, could observe little or no improvement of this function in infants later found to be congenital idiots. There is also on record a remarkable instance of an infant born without a cerebrum which lived

[1] W. Preyer, *The Mind of the Child*, Part I (1888), p. 124.

for three and one-half years. This child, we are told, "took the breast at once, and sucked properly from the beginning"; yet it showed no improvement, and soon had to be fed by a spoon. Later on, however, the attentive mother observed slight indications of sucking movements, and successfully tried the infant with a bottle, from which it was thereafter induced to take nourishment. Thus we can see that a certain foundation for the act of suckling is laid in the lower brain centers, though, without the co-operation of the cerebral cortex, it appears to be impossible to improve the act or perfect its selective function. As Sollier observed in the case of idiots, they respond as though the act were each time new to them.[1]

§ 4. *How, When, and Why Nature Is Right*

This long description of an original and in a high degree stereotyped behavior of mammals will serve as an introduction to the principles we must employ in understanding "how, when, and why nature is right." To give a brief and anticipatory answer to these questions, a fuller discussion of which will occupy us in the next chapter, we may say that nature operates rightly because the evolution of a distinct organism requires the most intimate coöperation between the situation in which the organism finds itself, and the total responses the organism itself gives. This is what was meant above when we referred to behavior as "a total dynamic pattern, the precise details of which

[1] Cited by Koffka, *op. cit.*, pp. 85 f.

vary according to the nature of the conditions under which the action takes place." The whole organism, by virtue of its very organization, is so built that it must behave "pattern-wise." Even the most undifferentiated "total-response" is something quite different from a gross attack upon the entire environment; for every organic response has a certain *rhythm* that enables us to describe it as a "pattern." [1] Those organisms we call defective still show the outlines of this pattern, and their "incompleteness" is more strictly an inability to function appropriately than a want of certain parts which the "normal" organism may possess. True though it is that some organisms are actually defective in sense or limb, and are consequently blind or deaf, armless or legless, the defects of mind which characterize the idiot are more adequately described in terms of the "precise details" of a pattern of behavior, and the failure of this pattern to vary with the conditions under which the behavior is called forth. The foundations of behavior may be laid, but the superstructure is wanting because the idiot is unable to educate himself.

Only by studying this intimate connection between situa-

[1] The "rhythm of behavior" is not necessarily a regular recurrence of pulsations, as we find them, for instance, in even measures composed of two or three beats and their multiples. According to a recent writer (E. A. Sonnenschein, *What Is Rhythm?* 1925, p. 16), "rhythm is that property of a sequence of events in time which produces on the mind of the observer the impression of proportion between the durations of several events or groups of events of which the sequence is composed." Although this definition refers primarily to the rhythm of language, the idea of a proportion between the durations of events is at once applicable to a constructive rhythm of behavior, and justifies our use of the term *pattern*.

tion and response shall we be able to understand how nature is right in what she does for, with, and by living creatures.

When is nature right? Is nature always right? Rousseau seemed to think that she was, and his doctrine of *Return to Nature* has often been understood as offering a panacea for all individual and social ills. But we have seen that nature furnishes different endowments to different individuals—some of whom are "normal" and others "defective." What is right for the normal individual cannot be right in the same way for a defective. Nature also provides different environments as well as different species of living beings to inhabit these environments. The question is therefore far from simple, and an answer can be given only in terms of environment and of the creature involved in behaving to this environment. Here again the intimate connection of situation and response must furnish an answer, and the implications for a philosophy of life can be appropriately drawn only when we know what we are talking about.

This is true, too, of the question, Why is nature right? For in a certain sense nature must be right or things would not be as they are. In other words, our sense of values is necessarily derived from what we find in existence, and the broad principles which underlie any philosophy must take their roots in what we call the "facts of existence." But here many questions are raised to which many answers have been given.

While it is not our task to describe and criticize these

answers, it will be helpful to the reader to know how we propose to meet the general problem. Let us therefore state at once that the facts of existence upon which we shall rely are the data of experiment. Whatever can be observed and recorded under experimentally determined conditions is something that can be repeated and observed again by others. The guarantee of existence is therefore found in the control which the scientist is able to exert over the appearance and disappearance, the rise and fall, of the event observed. Aside from the broad and general statement that nature is right because it exists as a fact which can be experimented upon, the details of value as applied to this or that method of obtaining this or that result are a matter for experiment to decide. In other words, you cannot tell whether anything is "good" or "bad" until you *try* it.

But we have not yet answered the question of value; for if worth attaches to everything that exists, why should any distinctions be drawn? Why should not one thing, or one way, be as good as another? Why is not the defective child with his crude nursing as good as a normal child with his self-regulating perfection of behavior? As a matter of fact the behavior of the defective child is quite as true and quite as real as the behavior of the normal suckling. Yet by comparison the behavior of the normal infant is somehow richer, fuller, livelier than that of the defective. Even a scientific observer is not content to record mere facts, but must needs go farther and compare them with

reference to their likenesses and their differences, and formulate them with reference to the order of their appearance, their cause, and their interrelationship. But comparison and formulation might seem to carry us beyond science into the realm of speculation; indeed, that is just the opinion of those who regard facts as independent self-sufficient data, existing each in its own right, quite apart from everything else. We, however, shall maintain a different view. Facts for us are not isolated, self-sufficient entities, but are, instead, dynamic patterns, the very existence of which involves form. Furthermore, the genetic identity of one form with another of simpler or more complex quality furnishes at once the basis for values, good, bad, and intermediate.

Education is not promoted by a speculative evaluation of facts which in themselves have no value; on the contrary, education is a "social process of change in the behavior of living organisms," which regulates and evaluates itself. The processes of behavior are self-regulatory, as we have found them to be in nursing; and under experimental conditions they show variations of perfection which enable us to say that the normal infant adjusts himself adequately to the conditions of nourishment, whereas the defective infant does not.

This view must not be confused with *utilitarianism*, or with the vague notion of a guiding purpose. The self-regulation and perfection of which we speak are not imposed upon the organism by the consequences of its behavior, past

or present, nor are they attributable to some inner light of reason or inspiration. Instead, the inherent features of behavior regulate and perfect their own pattern. Nature is therefore "right" in the measure in which external and internal conditions permit an appropriate expression of the limited capacities of a particular organism in its particular environment. Properly speaking, behavior is not a response to a situation, but a *situation-response.* Whether a certain behavior is "good" or "bad" depends upon its formulation and a comparison with other "situation-responses." But instead of supposing that the "facts" of behavior are first given, and afterwards compared and formulated by some higher process of the mind, we maintain that comparison and formulation are inherent in the behavior itself. For instance, a nursing child is a dynamic pattern of behavior. Just how well or how ill the child takes nourishment is determined by the total "situation-response," and not by sucking, tasting, swallowing, etc., as if these were so many separate acts which, when added together, constitute nursing.

CHAPTER II

ORIGINAL FORMS OF BEHAVIOR

§ 5. *The Nature of Instinct*

We found nursing to be an original mode of behavior which, in the normal infant, achieves a high degree of perfection within a very short time after birth. Behavior of this type is commonly described as *instinctive*. Broadly speaking, an instinct is any complex adjustive behavior that does not require to be first learned before it can be employed. In other words, an instinct is a dynamic pattern which is more or less perfect the first time it is tried.

But instinct has other characteristics, the most important one being, perhaps, that which Lloyd Morgan describes as "persistency with varied effort." Within the general range of its dynamic pattern an instinct may employ the most varied efforts in seeking its end; and it will persist in these efforts until either the end has been attained, or exhaustion, or some strong counter-attraction, supervenes. From all of which it appears that no mere inventory of separate acts, with or without a definite serial order, is adequate to describe an instinct. An organism is confronted by a situation which makes an original appeal, as the touching of the cheeks or chin of an infant, or even the lips in sleep. The response which ensues is somehow suited to the mode of stimulation;

but it is also controlled, in large degree, by internal conditions, such as those of hunger or satiety.

So we may say that certain original types of appeal are accompanied by certain original modes of response. The details of the response vary more or less with the detailed nature of the appeal, the response being as a whole conditioned by the present state of the organism, which also determines the persistency of the act and the varied efforts made in carrying it out. It is impossible to phrase a just statement of this process without a somewhat erroneous implication of successive conditions and events. In truth, however, the temporal sequence of events is far less significant than the total pattern with its inclosure of beginning and end. If conditions permit one to arouse an instinct in more than one way, the pattern comes full-fledged into existence, as has been instanced by the pursed lips and swallowing which Watson reports of infants in their sleep when the corners of the mouth are lightly touched, whereas sucking ordinarily takes place after the nipple has been introduced into the mouth.

It is therefore wrong to regard instinct as a combination of the acts into which it can be separated; for the separation of the course of behavior into units of activity is an arbitrary, and at times an impossible task. But even granted that such a separation can be made, the freedom with which the acts combine in fulfilling Lloyd Morgan's dictum of "persistency with varied effort" leaves one without a vestige of support for an interpretation of instinct in terms of a

combination of individual unit-activities. The only explanation in consonance with a true description of the facts forces us to regard the whole course of the behavior as genetically prior to its parts—a conclusion which has important bearings upon the interpretation of all behavior and of education.

§ 6. *The Nature of Reflexes*

Among the varied forms of behavior found in living organisms there are some, however, which by virtue of their simplicity, immediacy, and invariability have been termed *reflexive*. The reflexes are a "touch-and-go" type of behavior which in a multicellular organism of the segmental type—such as a vertebrate—are more or less discrete responses of the particular segments that happen to be stimulated. With these facts an attempt has been made to give a very simple explanation of even the most complex forms of behavior. Assuming that the segmental reflexes are each of a unit-character, what is more simple than to suppose that complex behavior is but a summative effect of the units which happen to be active at the time? If we assume a variable irritability or "readiness" of response on the part of different units, it is possible to conceive behavior as a combined effect of these numerous units of response, some of which facilitate the action of each other, and thus go together, while others, being mutually incompatible, check and inhibit one another. The entire scheme of behavior is in this way reduced to a complex of units, each working out its own destiny.

The difficulty about this simple and attractive explanation of instincts as chained reflexes is not a difficulty of logic—at least not of formal logic—but a difficulty of fact. Even investigators who are committed to this method of explanation—like John B. Watson—have been forced to remark that the reflex is by no means so invariable as its unit-character would seem to require; furthermore, the entire theory is bound up with certain implications of formal logic which falsify the more fundamental though less well understood principles of *bio-logic*.[1]

In modern educational writings one frequently meets with a warning to avoid a logical and favor a psychological method of teaching. What is meant by this warning is that the development of a subject in accordance with the principles of formal logic—by classificative definition, and reasoning—can be understood only by those who already know their logic. A child, on the other hand, who is still acquiring the data upon which these principles rest, and who can therefore not yet realize them abstractly, must be led into a subject of study by a more natural route, that is, through a psychological rather than a logical method of developing the subject.

Unfortunately, sound as this advice is, we know as yet too little of the psychology of childhood to be able to apply it successfully and understandingly even in those instances where we are most insistent upon its application. For the

[1] We shall employ this term to indicate the philosophy of organism and behavior, both individual and social.

logic we need in the instruction of the young is biological rather than formal; and, though formal logics have been written again and again since the classic work of Aristotle, no one has yet written the more fundamental and far more important *bio-logic* which education requires. Thus it happens that the fallacy of chained reflexes, together with all the devastating implications which this theory has for behavior, rests upon a purely formal attempt to reduce that which means or implies complexity into that which means or implies simplicity; whereas science must concern itself first of all with facts, rather than with meanings and implications.

The most important aspect of a mode of organic behavior at any time or place is its unified totality. The whole man, the whole insect, or the whole cœlenterate: these are the primary agents of response, all partial responses which analysis may reveal being subsidiary to and dependent upon the fully rounded dynamic character of the total-response. Instead of saying that instinctive and other forms of behavior are a sum of reflexes chained together by a process of accretion which works either in the process of evolution or through the formation of specified habits, we should say just the reverse; namely, that a total, vague, and undifferentiated response becomes, through a creative effort, differentiated and discrete. Out of the whole generate the parts; out of a primordial diffuse total-response come both instincts and reflexes through racial development, and likewise all habits and voluntary responses through individual development.

A pretty example of this evolution in the life-history of

a single organism is furnished by *amblystoma*, a salamander which in its larval state makes avoidance-reactions of the head, and can also swim with a snakelike motion (see Fig. 1). Prior to the development of its spinal reflexes, the excitations necessary to these modes of behavior are all communicated by peripheral ganglia to the head or brain. Later in its development the spinal reflexes mature and replace this total-reaction with the segmental type of behavior we call reflexive. From this, C. J. Herrick and G. E. Coghill, who have investigated the reactions of *amblystoma* in its various developmental stages, conclude "that the 'typical' two-neurone, short-circuit connection between dorsal and ventral root-fibers . . . appears late in development and is not to be regarded as a primitive form." [1] In another connection Herrick writes:

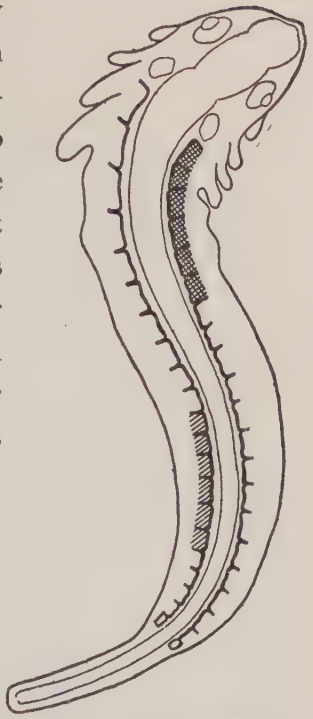


FIG. 1—The second phase of the swimming movement of an Amblystoma larva. During the first phase, which follows the application of a stimulus to the right side of the animal, the head is turned leftward. The contraction of the "myotomes" of the left side passes downward until it is located in the single cross-hatched region which causes the tail to curve as shown in the figure. Meantime, a second contraction of the head-region, indicated by the double cross-hatched portion, causes the head to turn rightward. (*After Coghill.*)

The concept of the reflex is not a general master-key competent to un-

[1] Cf. "The Development of Reflex Mechanisms in Amblystoma," *Journal of Comparative Neurology* (1915), *25*, pp. 84 f.

lock all the secrets of brain and mind, as some seem to suppose, and it has of late been subjected to very searching physiological analysis. . . . Attention should be especially directed to the futility of attempting to derive intelligence and the higher mental faculties in general from reflexes, habits, or any other form of fixed or determinate behavior. On the contrary, these owe their origin to the more labile and plastic components of behavior, which are determined, if you like, though not by rigid innate organization, but rather by individual experience acting through and upon the innate units and re-combining these in new patterns. The nervous system is more than an aggregate of reflex arcs and life is more than reaction to stimuli.[1]

§ 7. *The Logic of Instinct*

These observations, when combined with many others bearing upon the development of the central nervous system, indicate that the integration of the originally diffuse total-responses mediated by ganglia near the surface of the body is paralleled by "a progressive individuation of particular reflex-circuits and their segregation out of the primordial general nervous matrix." Is this conclusion, that instinct precedes reflex in the developmental series, illogical? Not at all; for although the actual course of development is no more deductive than inductive, the logician tells us that these two types of inference are but the obverse and reverse of one and the same process. A general term is not conceivable except as embracing particulars, and particulars, in turn, require a generalized setting for their consideration. Creighton has described this process as follows:

[1] Cf. C. J. Herrick, *Neurological Foundations of Animal Behavior* (New York: Holt, 1924), p. 234.

What we really obtain through an inductive inference is not only a general law, but also a perception of its concrete application to particular phenomena. This being so, it is clear that Induction and Deduction are not two different kinds of inference. Inference always implies an effort on the part of the mind to see how phenomena are necessarily connected according to some general principle; and, in carrying out this purpose, the mind must begin with the knowledge which it already possesses. When the general law of connection is known, and the object is to discover the nature of some particular fact, the method of procedure is deductive. But, when the problem by which we are confronted is to read out of the facts of sense-perception the general law of their connection, the method of inference which must be employed is that of Induction. But, from whatever point we set out, and whatever may be the immediate object of the inference, the result is always the same—an insight into the necessary connection of facts according to some general principle.

It is not unusual to hear the remark made that modern science has been built up by the employment of the inductive method. This must not, however, be interpreted to mean that deductive inferences are not also used in the discovery of scientific truth. Science (which is simply another name for systematic knowledge) is the product of thinking; and thought, as we have seen, is not limited to any one mode of procedure. Thought aims at extending knowledge, and so long as it can find any link of connection, or guiding thread, it is not limited to any one direction, or to any fixed mode of working. It is, of course, to be admitted—and this is true in the statement which we have quoted—that general laws cannot be discovered without an examination of particular facts, and that their validity must always be tested by comparison with the facts. But as soon as a general law is discovered in any field, it is always used as a principle from which to deduce new results. When it is possible to employ mathematics in the calculation of these results,

it is usually possible to extend our knowledge of the subject much more rapidly than before. Thus physics and astronomy owe their rapid development to the application of mathematics. It must be remembered, however, that this presupposes a certain stage of advancement—a certain inductive stage, as it were—on the part of the science. But even in this earlier stage we are constantly employing deduction, always reasoning out the results of certain guesses or suggestions to see if they hold true. Both in ordinary life and in scientific procedure Induction and Deduction are constantly employed together as mutually supplementing each other in the work of organizing experience.[1]

The logic of instinct and reflex falls within this general provision that analysis and synthesis, deduction and induction, go hand in hand. Not only is our derivation of reflex from instinct logically sound as an inference, but the very processes of integration and individuation referred to as being parallel in the conclusions reached by Herrick and Coghill are a biological counterpart of the higher processes of reasoning and inference.

But the logic of instinct can be carried a step farther, and at the same time in a manner which we shall have occasion to elaborate upon in Chapter IV. The logician speaks of two kinds of definition: (1) the twofold division by contradictories, and (2) the multiple division by limits or contraries. The first of these establishes the laws of identity, excluded middle, and contradiction, all three of which are derived from the proposition that a thing is either *A* or *not-A*. In other words, the particularity of anything is such that

[1] J. E. Creighton, *An Introductory Logic* (4th ed.; New York: Macmillan, 1922), pp. 387 f.

it can always be placed either within or without a certain class. The adequacy of this classification is determined by an inherent quality of the particular, and not by any prearranged scheme. In other words, a natural dichotomy permits of no choice.

This is the principle of dichotomy, and it is applicable to all primitive modes of behavior. Concretely, an act of behavior stands off as a pattern, or figure, upon an undifferentiated ground. In this way it becomes a particular act. However vague and lacking in precision, so much of whatever it might be as emerges to become what it is stands out against a less differentiated and less articulate ground. What it is which thus emerges in the first instinctive response of suckling may be crude and ill-defined; yet such definition as the act possesses is not comparable to anything else present at the time. Instead, an original act is in dichotomous opposition to its surroundings—that is, to the inarticulateness of any other effects produced by internal or external stimuli simultaneously present. This emergence of a dominant tendency of behavior, held together not by a linkage of parts but by an articulation of the whole into one pattern, constitutes the most primitive "all-or-none" type of behavior.[1]

[1] For confirmation of this view by a zoölogist, cf. Charles M. Child, *Physiological Foundations of Behavior* (1924). "All the evidence," writes Child, "indicates that mosaic development and self-differentiation are, with certain exceptions, secondary conditions in development" (p. 11). Also: "Summing up, the reflex, strictly speaking, is a specialized behavior-pattern depending on the presence of certain morphological mechanisms; but it is physiologically a development from the primary organismic behavior-mechanism, the excitation gradient" (p. 235). I question the appropriateness of the term *mechanism*.

The second type of classification of which the logician speaks is that of *similarity* and *difference*. Again quoting Creighton:

A scientific or natural classification . . . has for its purpose the statement of real likeness or resemblance. It seeks to find and group together the things which are related in some essential point. Consequently, it selects as its principle of division some property which appears to be a real mark of individuality, and to be connected with changes in other properties. Such a real principle of natural classification is rarely found by comparison of merely one property or set of properties in the things to be compared. To classify according to a single property may be a convenient method of giving names to any group of individuals, and of arranging them in such a way as to be useful to the student. It does not, however, give any adequate idea of the properties and true relations of the individuals compared. A really scientific, or natural, classification must be based upon a study and comparison of all the discoverable properties of the different individuals to be classified. It is only in this way that their real resemblances and affinities can be brought to light.[1]

Here, then, in addition to the dichotomous opposition of *A* and *not-A*, we have to do with the various aspects, or members, of *A*. The thing or aspect classified belongs to *A* as one of its ingredients, and the object of this classification is to exhaust the possibilities of *A*. To do so one must comprehend likenesses and differences, and above all the principles of serial order and gradation. Before we can arrive at the special features or members of *A*, the varying means whereby *A* emerges from its background of inarticulate *not-A* must be taken into consideration as determinants

[1] *Op. cit.*, p. 80.

of behavior. In place of the "all-or-none" type of response, we have here a more highly articulate and differentiated response, all the phases of which lie within the one pattern of *A*, though differing in detail as the conditions of *A* warrant such differentiation.

While it would perhaps be impossible to draw a hard and fast line between these two types of behavior, a crude illustration of what we have in mind has already been afforded us in the distinction we found between the operation of nursing in a defective child and the same act described by Watson in normal children. Whereas the defective child fulfilled only the bare requirements of nursing, without showing any improvement of technique, normal infants, like Preyer's son, soon distinguish slight variations in the constitution of the liquid they take, and alter their behavior accordingly. It is in pursuit of this line of development that all finer differentiations of behavior arise, and with these, also, the very logic which has become formalized in abstract terms, and to which we have had recourse in pointing out the distinction that must be drawn between bio-logic and formal logic as applied to the behavior of living beings. We do not deny logic, but affirm it, when we state that the whole is prior to its parts, and furthermore that the whole is always something more than a mere sum of its parts. For parts come into existence, not through any external device of enumeration, but through an inherent process of differentiation which leads those organisms possessed of the requisite capacity to express their individual differences. A sum-total of parts,

as we find them in a machine, is always in a sense artificial, never constituting a true whole.

Thus the logic of biological development traces its course from the vague total-response to the highly detailed and variable pattern involving semi-independent parts or members; and from the original matrix of a relatively undifferentiated behavior there arise instincts and reflexes, voluntary acts and habits. While no hard and fast lines of cleavage can be drawn, yet by reference to these four types of response we are able to classify behavior, and to infer the means whereby an adequate education is possible.

It should be noted, however, that without education bio-logic does not inevitably pass into formal logic. As regards the logic of primitive man, A. A. Goldenweiser writes:

> It will be observed that the psychophysical processes involved are direct, pragmatic, teleological. There is in this domain some of the implied reason that is characteristic of animal adjustments, which also bear apparent evidence of intellectual acumen, the sort of adjustments so often noted in the industrial life of the bee, the ant, the spider, the beaver. The logic observed in early tools and weapons, traps and snares, pots, houses and boats, is the logic of nature itself, the logic of the objective relations of things which, through the medium of action, molds the mind so inevitably and smoothly as to be almost wholly unconscious. And if consciousness and ratiocination arise in the course of the industrial activity, they are presently submerged, the objective results alone being passed on to the following generation. As the aim in all of these pursuits is not to know but to do, not to understand but to achieve, the realm of matter-of-fact becomes a happy hunting ground for the pragmatist, not an abode for the pursuer of the "idle curiosity."

There is satisfaction when the thing works, and, barring accidents, no further changes are made. Henceforth, the mind accepts these condensed depositories of reason traditionally. They become part of the technical equipment of behavior, not of thought and understanding.[1]

In other words, human inertia holds to its patterns of behavior, and once these are formed it is very difficult to modify them. Without the aid of an educational process, which by intention spurs us on to the discovery of new methods, we relapse constantly into the old and unchanging ways of life.

But whether new or old, the ways of life originate in an undifferentiated total-response which, in the course of phylogenetic development, gives rise to modes of reaction, some general and complicated, others special and stereotyped. The innate patterns which form the groundwork of all behavior are commonly called *instincts* when they are general and complex, *reflexes* when they are special and stereotyped.

§ 8. *Tropisms*

Simpler and relatively undifferentiated forms of life, like *amœba*, possess innate modes of response in which a distinction between reflexes and instincts is not readily drawn. Biologists sometimes refer to these responses as *tropisms*. For instance, certain organisms are so constructed that they make a more or less invariable response of avoidance when they are stimulated by light; this is called a negative photo-tropism. Other organisms are oppositely attuned;

[1] *Early Civilization* (New York: Knopf, 1922), pp. 406 f.

they are attracted by light—as the moth is—and are therefore positively photo-tropic. Other tropisms are attributed to gravity, heat, electricity, etc. A tropism involves the entire organism, and is therefore general, like an instinct; but it also shows a degree of invariability which makes it like a reflex. The simple structure of a unicellular organism, the restricted field of its sensitivity, and the limited range of its reactions, all conspire to bring its activities into closer relationship with the primordial undifferentiated matrix of behavior than the wider possibilities of multicellular organisms permit. Yet the behavior of simple organisms, strictly speaking, is not undifferentiated; indeed, careful observations reveal so great a wealth of variation in the response of even so simple an organism as amœba that H. S. Jennings can write that he "is thoroughly convinced, after long study of the behavior of this organism, that if amœba were a large animal, so as to come within the everyday experience of human beings, its behavior would at once call forth the attribution to it of states of pleasure and pain, of hunger, desire, and the like, on precisely the same basis as we attribute these things to the dog." [1] Without going into the question of consciousness, which Jennings implies, it is evident from his statement that the behavior of these lowly creatures must involve more than the primordial "all-or-none" type of response.

We may conclude, then, that although tropisms are not either instincts or reflexes in the usual meaning of these

[1] *Behavior of the Lower Organisms* (1915), p. 336.

terms, neither are they primordial undifferentiated responses; for they possess the qualities common to all three: a generality which involves the whole organism, a certain flexibility which enables them to alter their behavior to meet varying conditions, and a certain fixity which narrowly prescribes the limits of variability. In a word, tropisms indicate whatever degree of flexibility the rather limited patterns of behavior in lower organisms make possible. Experiment has shown that a negative photo-tropism possessed by a species of cockroach can be changed temporarily into a positive photo-tropism, when the approach to the darkened area of a cage is followed by a painful shock. Under these conditions the insects speedily learn to avoid darkness, and seek the light, although the modification of behavior is not lasting, since they revert to their original propensity for darkness as soon as they are allowed to enter a darkened area without being harmed. This experiment shows that while the original propensity for darkness is fundamental to the cockroach, it is not unalterable; and that a photo-tropism is not an invariable mechanism.

When we come to higher forms of organism, we find responses of this order only in embryonic stages of development, although vestigial remains of the "all-or-none" response sometimes reappear under pathological and other abnormal conditions. In general, a higher organism shows a complex and highly differentiated behavior even from birth, because its very structure, as well as its differential sensitivity, demands varied responses to varied situations.

§ 9. *The Distinction Between Instincts and Reflexes*

It is among the higher forms of organism that we find an appropriate division of original acts of behavior into instincts and reflexes. In so far as the stimulation is specialized and the response restrictive, we call the behavior reflexive. The winking of the eyes, the contraction and dilation of the pupil under varying conditions of illumination, the accommodation of the lenses, and the convergence of the eyeballs, all are fairly well specialized, immediate, "can't-be-helped" types of response which warrant the name of reflexes. The involuntary knee-jerk, occasioned by tapping below the knee-cap of one leg crossed over the other, is a good example of a reflex; and the responses involved in breathing, digestion, and the circulation of the blood also fall in the same category. A more comprehensive mode of stimulation operating in conjunction with a wider-reaching and more fundamental condition of physiological readiness of the entire organism results in the less specialized type of behavior called instinctive. Lacking the means of an immediate adjustment which the reflex possesses, an instinct persists with varied effort until the disturbed equilibrium of the organism has been restored. When the situation that initiates and controls the behavior is external to the organism, we have the more or less definite responses of attraction and avoidance, which include locomotion and a variety of adjustive movements. When the situation is largely internal, we have impulsive responses that well up, as it were, from within, and express themselves by such

acts as wailing, crying, laughing, and smiling. Watson calls the former, or externally-conditioned responses, instincts proper, and the latter, emotions; he then proceeds to distinguish the two with reference to the nature of the activities which are involved. An instinct, he says, is an "explicit definitized and localized action," the movements being principally of the striped muscles. Emotion, on the other hand, is "implicit mass-action," which chiefly concerns the unstriped muscles and glands.[1] Thus external initiation and control moves the body by means of the skeletal muscles; the response is overt and of a definite pattern, such as walking, grasping, and nursing. Internal initiation, on the other hand, depends upon such general conditions as hunger and thirst, freshness and fatigue, which affect breathing, the circulation of the blood, digestion and the like. These impulses from within express the general bodily condition which promotes or retards glandular secretions and the activity of the smooth muscles.

§ 10. *Fear, Rage, and Love*

It is at once obvious that the internal and external modes of initiation and control operate in harmony and close connection with one another. Watson's researches upon the behavior of new-born infants have revealed three generic types of innate response, each of which combines the impulsive and implicit mode with an explicit adjustment to objective conditions. Of these three types, *fear*, *rage*, and *love*, he writes:

[1] Cf. *Psychology*, p. 252.

The principal situations which call out fear-responses seem to be as follows: (1) To suddenly remove from the infant all means of support, as when one drops it from the hands to be caught by an assistant (in the experiment the child is held over a bed upon which has been placed a soft feather pillow); (2) by loud sounds; (3) occasionally when an infant is just falling asleep or is just ready to waken, a sudden push or a slight shake is an adequate stimulus; (4) when an infant is just falling asleep, occasionally the sudden pulling of the blanket upon which it is lying will produce the fear-responses. (3) and (4) above may be looked upon as belonging under (1). The responses are a sudden catching of the breath, clutching randomly with the hands (the grasping-reflex invariably appearing when the child is dropped), sudden closing of the eyelids, puckering of the lips, then crying; in older children possibly flight and hiding (not yet observed by us as "original" reactions). In regard to the age at which fear-responses first appear, we can state with some sureness that the above-mentioned group of reactions appears at birth. It is often stated that children are instinctively afraid in the dark. While we shall advance our opinion with the greatest caution, we have not so far been able to gather any evidence to this effect. When such reactions to darkness do appear they are due to other causes; darkness comes to be associated with absence of customary stimulation, noises, etc. (they should be looked upon as conditioned fear-reactions). From time immemorial children have been "scared" in the dark, either unintentionally or as a means of controlling them (this is especially true of children reared in the South).

In a similar way the question arises as to what is the original situation which brings out the activities seen in rage. Observation seems to show that the *hampering of the infant's movements* is the factor which, apart from all training, brings out the movements characterized as rage. If the face or head is held, crying results, quickly followed by screaming. The body stiffens and

fairly well-coördinated slashing or striking movements of the hands and arms result; the feet and legs are drawn up and down; the breath is held until the child's face is flushed. In older children the slashing movements of the arms and legs are better coördinated, and appear as kicking, slapping, pushing, etc. These reactions continue until the irritating situation is relieved, and sometimes do not cease then. Almost any child from birth can be thrown into a rage if its arms are held tightly to its sides; sometimes even if the elbow-joint is clasped tightly between the fingers the response appears; at times just the placing of the head between cotton-pads will produce it. This was noticed repeatedly when testing eye-coördinations in infants under ten days of age. The slight constraint put upon the head by the soft pads would often result in a disturbance so great that the experiment had to be discontinued for a time.

The original situation which calls out the observable love-responses seems to be the stroking or manipulation of some erogenous zone, tickling, shaking, gentle rocking, patting, and turning upon the stomach across the attendant's knee. The response varies. If the infant is crying, crying ceases, a smile may appear, attempts at gurgling, cooing, and finally, in slightly older children, the extension of the arms, which we should class as the forerunner of the embrace of adults. The smile and the laugh which Freud connects with the release of repression (we are not denying in the case of adults this may be true) we should thus class as original reaction-tendencies, intimately connected from infancy with the stimulation of—in our opinion at least—the erogenous zones.[1]

We have reproduced this long quotation because of its manifest value as a description of some of the earliest forms of instinctive behavior in infants. In every case we see the intimate union of vague impulses welling up from within,

[1] *Psychology*, pp. 219 f.

and expressing themselves in the actions characteristic of comfort and discomfort, such as smiling and crying, together with the more "explicit definitized and localized actions" of grasping, of slashing movements, and of the extension of the arms which involve the skeletal muscles. We have before us three generic types of original response which characterize human beings, each unlearned as to its dynamic pattern, and each supplying a matrix, as it were, for both the formation of habits, and the diversity of voluntary control and selection. For in so far as experience defines and fixates these first crude and vaguely-formulated modes of behavior we have instinct replaced by habit. The fear of the dark, which Watson regards as more probably an acquired than an original behavior, is illustrative of this replacement. What he means by "conditioned fear" we shall have to explain later on (pp. 188 f.); but, if he is right, it is a habit which is thus conditioned. Voluntary selection likewise accrues to these primitive responses, as a product of experience or education, though it differs from habituation in its lack of fixation.

§ 11. *Habit and Volition*

The two types of education, the habitual and the voluntary selection of responses, parallel the two types of original behavior, the reflexive and the instinctive. Just as organic evolution produces certain specialized and relatively independent segmental units of response which we term reflexive, so the life-history of the individual, through the

practice of drill and repetition, produces the stereotyped modes of response we call habits. A total-response of an organism permits greater variability than a segmental response; consequently, as experience impresses its record upon the amorphous pattern of an instinct, the result is not only habit, where fixation is possible, but also what we call voluntary selection, where it is not. In rage, for instance, the original slashing movements of arms and legs become "better coördinated, and appear as kicking, slapping, pushing, etc." These may be termed *habits;* but the selection of the habit best suited to meet a particular situation of aggression—whether one should now push, or slap, or kick—is *voluntary;* that is to say, an adult's method of fighting depends upon the whole situation which confronts him, both external and internal, and is not merely a chance innervation of this or that set of muscles.

We may therefore call habits "acquired reflexes," resulting from drill or training. Volition, on the other hand, appears in selective reactions which embrace the wider range of the instinctive pattern taken as a whole. This is the kind of response we have in mind when we speak of education. Voluntary selection may, however, initiate habit, just as in racial history instinctive selection has initiated reflexes.

No clear lines of demarcation separate any of these modes of response. The organism is always an adjustive creature from its lowliest embryonic state of vegetation onwards to its highest forms of selective activity. The terms *in-*

herited and *acquired* are always relative as applied to behavior; for while the structure of the organism is an original determinant of its life and conduct, the influence of the environment in which a creature finds itself is felt from the outset. In the developmental forms of behavior—impulsive, reflexive, and instinctive—only the more pronounced influences of organic structure and sensitivity are observed; whereas the determinants of environmental situation and of memory shape our habits and our choice of action. As Child has pointed out, "development represents behavior as truly as any activities of the mature organism, and we have to distinguish, not between development and behavior, but between different aspects and phases of developmental and other forms of behavior."[1] Nevertheless, reflexes and instincts are the two main types of original or developmental response, the former being genetically subsequent to the latter; and habit and volition, in turn, are the two chief types of education, the former being subsequent to and dependent upon the latter. We shall later have more to say of habit-formation and training, as distinct from voluntary selection. In this portion of the book, which is concerned with original modes of behavior, we have now to consider some further aspects of instinct, because, since instinct is the prototype of all selective adjustment, it must furnish the key to our understanding of education.

[1] *Op. cit.*, p. 226. (See note on p. 27).

CHAPTER III

THE CLASSIFICATION OF INSTINCTS

§ 12. *Difficulties in Observing Human Instincts*

Since the original nature of man, and of other animals, provides certain more or less definite modes of response to a variety of situations, these must afford a starting-point for any revision or change in the animal's behavior. It thus appears that an inventory of the human instincts should furnish a very useful means of outlining the method of early education, and, indeed, the direction of all education. Unfortunately, our studies of the earliest forms of behavior in children, and even the behavior of those animals which might be useful in comparison, are still too incomplete to supply this information. It has been customary to classify instincts by reference to organic needs, such as food-getting, home-building, procreation, attack and defense, migration, etc.; but this method is apt to lead one into two errors. The first is to write down as necessary conditions all the requirements of life that one can think of, and thus to overlook many possibilities of response which do not obviously belong to such a ready-made, theoretical preconception. The second error is closely allied to the first, and is, indeed, this theoretical preconception itself.

In searching for the general requirements of life, one is naturally biased by the view that life serves a purpose, and

that the ends of behavior must control their beginnings. This is the fallacy of prevision, which leads one insensibly into *teleology*, or, the assumption that organisms must somehow be guided by a special purpose or end in the attainment of what they need in order to survive. That such guidance exists is obvious, since without securing nourishment, without avoiding attack, without finding shelter, without procreating its kind, the organism must inevitably perish and become extinct; yet despite these facts instinct is not explained in any real sense by merely saying that it is an innate propensity for survival. Indeed, all we have done is to state the problem. So far as education is concerned we have done less than nothing to promote a sound method of instruction. If innate propensities must remain a mystery, we might suppose, as Rousseau apparently did, that, on the whole, we had better leave nature to her own mysterious ways. It might also be reasonably concluded that the best education is no education at all, because nature will care for her own. Not only is such a conclusion practically unsound, as the followers of Rousseau immediately discovered, but the inquiring nature of man cannot be satisfied with mysteries. Little as we know of instinct and its definition, we shall not only persist "instinctively" with varied effort in our attempts to uncover its mysteries, but our only hope of securing a sound method of education rests upon the outcome of our researches.

Since at present we do not know how to classify the human instincts scientifically, we must continue for a time to

do what man has always done under similar circumstances, namely, content ourselves with empirical facts. By empirical facts we mean results of observation not as yet analysed or surveyed as regards their precise nature. In a word, empirical facts, though undoubtedly factual, have not yet been reduced to scientifically manageable terms. Water, for instance, is an empirical fact, undoubted as to its existence; yet in terms of hydrogen and oxygen and their affinity the chemist is able to understand the scientific nature of water, and thus to underwrite its empirical existence in exact terms.

The description of the original behavior of fear, rage, and love given by Watson is altogether empirical. The facts are there, but they are not yet reduced to scientific terms. Consequently, we find Watson's description lacking in precision. We cannot tell what are the essential features of the situations leading to these three distinct responses; neither are the three dynamic patterns defined in terms that can reasonably be surveyed. Hence it is that instinct remains a good deal of a mystery, and must so continue until our methods of observation and interpretation have considerably improved.

A special difficulty is encountered in the study of human instincts because the human being is so very helpless at birth. Lower organic forms come into the world much better equipped to struggle at once for existence. Man, on the contrary, requires so much care and nursing that one finds it extremely difficult to distinguish capacities, which are undeniably innate, from abilities, which are rapidly introduced into his behavior. It is for this reason that the de-

scriptions of man's earliest behavior, such as Watson has given, possess so amorphous and indefinite a character. Instead of being able to observe the organism reacting freely in a "natural" environment, we find the human infant always confronted by an artificial man-made situation in which light, temperature, food, and contact are all largely determined by zealous attendants.

§ 13. *The Instincts of Ammophila*

By way of contrast, we can observe in the life-cycle of the solitary wasp an expression of instinct called forth by the surroundings nature has provided, the responses to which are native to the creature itself. Take for instance, the behavior of *ammophila*, as described by the Peckhams:

> The males and females usually see but little of each other after mating is over, although we occasionally find them living happily together until the end of the season. In the early summer they begin to emerge from the nest in which the eggs were laid the year before. Solitary indeed they come into the world, the generation that gave them birth having perished in the fall. For a time their career is one of unmixed pleasure, and yet, free and unguided though they are, basking in the sunshine, feeding on the flowers, or sleeping at night under some sheltering leaf, they are hourly acquiring experience, so that when the cares of life descend upon them, they are no longer creatures of mere instinct. With these sobering cares an almost absurdly heavy sense of responsibility for future generations transforms the hitherto happy-go-lucky females into grown-up wasps with serious views on marketing and infant foods. Each one makes a separate nest and provisions it by her own labor; and in many cases a new nest is made for each egg. There is no coöperation

among them; although in certain genera, as Aphilanthops and Bembex, a number of individuals build close together, forming a colony. The nests may be made of mud, and attached for shelter under leaves, rocks, or eaves of buildings, or may be burrows hollowed out in the ground, in trees or in the stems of plants. The adult wasp lives upon fruit or nectar, but the young grub or larva must have animal food; and here the parent wasp shows a rigid conservatism, each species providing the sort of food that has been approved by its family for generations, one taking flies, another bugs, and another beetles, caterpillars, grasshoppers, crickets, locusts, spiders, cockroaches, aphides, or other creatures, as the case may be. When the egg-laying time arrives the female secures her prey, which she either kills or paralyzes, places it in the nest, lays the egg upon it, and then, in most cases, closes the hole and takes no further interest in it, going on to make new nests from day to day. . . . The egg develops in from one to three days into a footless, maggot-like creature which feeds upon the store provided for it, increasing rapidly in size, and entering the pupal stage in from three days to two weeks. In the cocoon it passes through its final metamorphosis, emerging as a perfect insect, perhaps in two or three weeks, or, in many cases, after the winter months have passed and summer has come again.[1]

One notes from this description that although the driving-force and the pattern of the insect's behavior are such as to warrant their attribution to a pre-natal endowment, the acquisitions of experience are also significant from the time the wasp bursts from its cocoon until its life is terminated. Yet this experience is not guided by the educative care of a previous generation or of other members of the species. The insect's behavior, as it builds its nest, stores it with

[1] *Wasps, Social and Solitary* (Boston: Houghton, Mifflin, 1905), pp. 15 f.

food, lays its egg thereon, and closes the nest, is altogether individual and suited to the conditions which the experience of the time provides. That these typical responses have nothing of the inflexibility of reflexes is clearly shown by the detailed descriptions which the Peckhams give of nest-building, food-seeking, the paralyzing of the prey and storing of it in the nest, and the final closure of the hole:

> In this species, as in every one that we have studied, we have found a most interesting variation among the different individuals, not only in methods, but in character and intellect. While one was beguiled from her hunting by every sorrel blossom she passed, another stuck to her work with indefatigable perseverance. While one stung her caterpillar so carelessly and made her nest in so shiftless a way that her young could survive only through some lucky chance, another devoted herself to these duties not only with conscientious thoroughness, but with an apparent craving after artistic perfection that was touching to see.
>
> The method employed by the Ammophiles in stinging their prey is more complex than that of any other predatory wasp. The larvæ with which they provision their nests are made up of thirteen segments, and each of these has its own nervous centre or ganglion. Hence if the caterpillar is to be reduced to a state of immobility, or to a state so nearly approaching immobility that the egg may be safely laid upon it, a single sting, such as is given by some of the Pompilidæ to their captured spiders, will be scarcely sufficient.[1]

The number of stings and the exact precision with which they are administered were found to vary with different insects. One was observed to sting its prey first between the third and fourth segments, then successively between

[1] *Op. cit.*, pp. 22 f.

the third and second, and between the second and first. "For a moment the wasp circled above it, and then, descending, seized it again, further back this time, and with great deliberation and nicety of action gave it four more stings, beginning between the ninth and tenth segments and progressing backwards." Another wasp began as described in the previous instance, but followed by stinging the fourth, fifth, sixth, and seventh segments, where she stopped, leaving the posterior ones untouched. In a third case, the first and only sting was, as in the other instances mentioned, between the third and fourth segments; "she then spent a long time in squeezing the neck, pinching it again and again."

Variability within a general scheme of behavior which warrants our employment of the term instinct was also the rule in filling and closing the nest. A remarkable instance is recorded of one little wasp:

> We remember her as the most fastidious and perfect little worker of the whole season, so nice was she in her adaptation of means to ends, so busy and contented in her labor of love, and so pretty in her pride over the completed work. In filling up her nest she put her head down into it and bit away the loose earth from the sides, letting it fall to the bottom of the burrow, and then, after a quantity had accumulated, jammed it down with her head. Earth was then brought from the outside and pressed in, and then more was bitten from the sides. When, at last, the filling was level with the ground, she brought a quantity of fine grains of dirt to the spot, and picking up a small pebble in her mandibles, used it as a hammer in pounding them down with rapid strokes, thus making this spot as hard and firm as the surrounding surface. Before we could recover

from our astonishment at this performance she had dropped her stone and was bringing more earth. We then threw ourselves down on the ground that not a motion might be lost, and in a moment we saw her pick up the pebble and again pound the earth into place with it, hammering now here and now there until all was level. Once more the whole process was repeated, and then the little creature, all unconscious of the commotion that she had aroused in our minds—unconscious, indeed, of our very existence and intent only on doing her work and doing it well—gave one final, comprehensive glance around and flew away.[1]

The use of a "tool" by an insect, which has also been carefully observed by many other investigators,[2] is so striking a parallel to the behavior of higher forms of animal life—notably the primates—that we must regard it as one of the rare accidents of instinctive variability. Yet at the same time we are constrained to remark that if instinct were the invariable mechanism which it is sometimes thought to be, this ingenious employment of a pebble would be inconceivable.

Despite these curious variations, instinctive behavior is nevertheless more restricted in its dynamic form than the selective behavior described as voluntary. An instance of this limitation is given by an observation of H. Volkelt upon the behavior of a spider towards its prey the fly. A spider, busily devouring a fly which it had dragged from the web into its tubular nest, was observed, when a second fly became enmeshed in the web, to stop eating, dart forth

[1] *Op. cit.*, pp. 38 f.

[2] Cf. W. M. Wheeler, *Social Life Among the Insects* (1923), p. 55.

and sting the second fly, then return and finish its meal before emerging again to carry the prey to its nest. Here we have a fairly eleborate and, as we might say, well considered behavior; yet when a third fly was carefully introduced by artificial means, not into the web but directly into the passage of the nest, the spider, instead of attacking the fly as it had done before, showed evidence of fear and ran madly away from the intruder.[1]

It is apparent, therefore, that the nature of the situation controls instinctive behavior, and that such variations of means to ends as are possible to lower forms of life are subject to conditions the details of which are obscure. The opinion may be expressed, however, that situation and response operate together as one unit, the general pattern of which as it unfolds itself is constantly conditioned by subtle variations both in the situation and in the organic readiness for response. The impulse which motivates the response is to "follow through" by whatever means are available, sometimes hurriedly and crudely, sometimes patiently and with finesse, until an end is achieved which closes any gaps that can be "felt" by the organism in the incompleteness of the behavior.

The life-cycle of ammophila holds together, although many subsidiary cycles of activity unroll themselves and roll up again within the total life-span. We find difficulty in this conception only when we are imbued by the supposi-

[1] Cf. "Über die Vorstellungen der Tiere," *Arb. z. Entwicklungspsychologie, 1*, 2 (1914), pp. 15 f.

tion that each act is separate and distinct from every other; in which case, of course, the beginning and the end of a transaction can have no material connection one with the other. But this conception is altogether artificial, because life is a process, and to reduce this process to a succession of separate acts, each one independent of the other, is to do violence to its intrinsic nature. It should always be borne in mind that the analyzed parts of any complex whole tell us only of the nature of this whole; they do not tell us that the whole is a mere aggregate of these parts. While a method of counting serves adequately enough in some instances—as in numbering the beans in a bag, or the pebbles in a pail—it is more questionable when applied to the successive acts of ammophila in the fulfillment of her life-cycle, or even to the spider in its predatory activities.

But even this injunction to regard instincts as variable, though patterned, responses to complex, though likewise patterned, situations, leaves us with very little insight into the means whereby these remarkable ends are achieved. Nor is our problem of education solved by merely setting aside the instincts as mysterious innate propensities, leaving "experience" to teach new acts with the aid of "reasoning." Whatever the conditions may have been that determined ammophila to employ a pebble as a "tool," and whatever it was in the situation of a fly in the nest-passage that awakened fear rather than pugnacity in the spider, each insect made a response which our knowledge of organic

behavior could not have led us to expect. It is essential that we should improve this knowledge if we would understand the springs of action, for without such an understanding our methods and principles of education must remain the superficial generalizations upon empirical data which they now are. The interesting description of the Peckhams is just as "empirical" as the description Watson gives of an infant's behavior in fear, rage, and love. We do not know what we mean by the "situation" which provokes these responses, nor what the basis is of that conformity of response which underlies all adjustments, whether innate or acquired. All we can say is that the situation seems to emerge as a patterned and somehow articulate whole within its less articulate surroundings, and that this "emergence" involves a corresponding pattern of behavior attuned to the situation, and varying with its variation until what is unrolled in time and space rolls itself up again in the completion of the act.

General though it is, this statement is intended to serve as a key to all behavior, including the highest and most intellectual types. Thus far we have been dealing only with the description of responses which are somehow prescribed by the nature of the organism and its action-system. In later chapters we shall deal with that phase of behavior which we have thus far vaguely referred to as "experience"; but first we must return to the classification of instincts, and add a few general remarks upon the initiation and the development of these innate forms of behavior.

§ 14. *Three Modes of Instinctive Behavior*

Although many classifications of instinct have been attempted by different students of the subject, we shall make no effort to review these, but instead will adopt a very simple scheme suggested by the late W. H. R. Rivers, because it falls more directly in line with the principles we have just stated than do most of the elaborate classifications made by other writers. It is as follows:

> Instincts may be classified as of three main kinds—those of self-preservation; those which subserve the continuance of the race; and those which maintain the cohesion of the group, whether this group be a clump or herd of animals, or the more complex mass of individuals which makes up human society with its highly varied forms of grouping.[1]

Without committing ourselves to the rather obvious teleology implied in this statement, and reserving the right to consider as instinctive those types of response which are not characterized primarily by their serviceableness, it is apparent that some forms of human behavior are individual, while others are social, and that there is in addition a distinctive group of responses which have their nucleus in the processes of regeneration. Each of these general classes exhibits the two aspects which have led Watson to distinguish between the behavior of emotion and the behavior of instinct proper. Emotional behavior is essentially appetitive, representing as it does impulses which well up from within the organism, and which find their expression

[1] *Instinct and the Unconscious* (1920), p. 52.

in implicit mass-reactions of the "all-or-none" type. On the affective side these original dispositions are all-embracing, and have, if unrestrained, the devastating consequences of high passion. The original and undifferentiated *affect* of appetite or desire is defined by the explicit *effect* of the particular "definitized and localized action" of which it is a member. Thus the general processes of *attraction* and *avoidance*, which are antecedent to any real distinction of individual, social, or sexual manifestations, lay foundations for the fundamental affections of satisfaction and dissatisfaction. These general processes of attraction and avoidance are likewise involved in each of the three modes of explicit response which furnish our classificatory groups. The individual instinct which Rivers calls self-preservation manifests itself in attraction and avoidance, with their corresponding satisfaction and dissatisfaction. The same is true of social and sexual instincts. What differentiates these three modes of behavior is not the "all-or-none" principle of impulsion from within toward an attractive or away from a repellent object or situation; on the contrary, these three modes differ with respect to the pattern of behavior. Whereas a strictly individual response can be made to a stimulating situation, both social and sexual responses are reciprocally participative, at least two individuals of like nature being involved in each. The distinction of social and sexual responses is, in turn, based upon the kind of participation that is involved.

These distinctions are clarified when we consider some

of the varieties of innate behavior which fall into the three classes, although the mode of their evolution from the "all-or-none" responses of attraction and avoidance makes it impossible to regard them as quite independent of one another.

CHAPTER IV

INDIVIDUAL INSTINCTS

§ 15. *Fear and Rage*

The original responses of fear and rage, which Watson has described, belong to the category of individual instincts, the one being a manifestation of avoidance and the other a specialized form of attraction. As Rivers points out, fear may show itself in the behavior of flight, or in immobility and collapse. Flight, which is an active definitized locomotion, is sometimes checked or suppressed in favor of complete immobility—the death-feint of animals—or by a complete collapse when internal conditions inhibit the responses which might carry the organism out of danger. Rivers has suggested that—

> Failure of the instinct of self-preservation [takes] place in animals when instinctive reactions to danger have been so overlaid by reactions of other kinds that, in the presence of excessive or unusual stimuli, the instinctive reactions fail. It is noteworthy that collapse with tremor seems to be especially characteristic of Man in whom all the different modes of reaction to danger found in the animal kingdom are present in some degree, but no one of them so specially developed as to form an immediate and invariable mode of behavior in the presence of danger.[1]

The instinct of rage, on the other hand, while it may supervene upon fear, as when an animal in flight is brought

[1] *Instinct and the Unconscious*, pp. 55 f.

to bay, has the character of an attraction towards the object of aggression. Thus, in fighting, an animal will lunge forward and attack its opponent with a technique that varies from species to species. While the broad outline of the pattern of fighting is determined by the nature of the animal, it is also subject to a development in which both maturation and learning participate. The young puppy evinces the same general behavior of fighting that is found in the grown dog; but he usually refrains from driving his sharp teeth into the other dog's skin, as his strength would readily permit him to do. We term such behavior *playful;* but, although an aggressive intention appears to be lacking, the behavior itself has the form of fighting.

In addition to the gross bodily responses to danger and attack, higher organisms exhibit a variety of subtle reactions belonging to the same categories of behavior. Avoidance does not necessarily mean flight or collapse; it expresses itself also in shyness, modesty, and submission. Attraction, in turn, is not always the aggressive rage of combat; it may also express itself in an attitude of self-assertion and mastery. While these expressions differ from those of fear and rage, they indicate a common origin by the fact that an attitude of submissiveness is conducive to fear and flight, and an attitude of assertiveness is conducive to rage and fighting.

Both these individual instincts undergo marked change under social control. Individual development leads from bodily manifestations of fear and rage to refined methods

of expression in representative forms. A "fear" of God may be altogether ideational, while the common saying that "the pen is mightier than the sword" indicates a means of expressing anger without relevant bodily manifestations. Furthermore, social expressions of fear and rage include group-responses, such as the fear invoked by religious "revivals," and the fierce and bloodthirsty anger of warfare. In each of these cases a group will do things that an individual apart from a group would be incapable of doing.

§ 16. *Hunger, Thirst, and Curiosity*

There are many individual responses that possess an original component of instinct. Nursing, which we have already described, is one; and there are others connected with the satisfaction of *hunger* and *thirst:* the seeking of food and water, involving the predatory design of hunting and stalking the prey, which at the proper moment may also introduce the aggressive behavior of fighting. These and other forms of behavior are individual instincts initiated by the impulses of hunger and thirst. While the most characteristic feature of an instinct is the attraction of the particular situation that confronts the animal, and an active disposition to alter the situation by varied effort until the desire which initiates and controls the responses has been satisfied, there is, as always, a negative side. In feeding, *repulsion* occurs whenever the food fails to satisfy the demands of the organism. Thus the babe may refuse

thinned or unsweetened milk, and other animals may show signs of disgust when the food they find is not palatable. The characteristic response of repulsion is that of spewing the distasteful substance from the mouth, a response quite as definite as the opposite behavior of nursing or mastication.

There are many other specialized individual forms of instinctive behavior. *Curiosity* is one, and a very important one, since it involves those springs of action which, while less insistent than the imperious demands of aggression and escape, of hunger and thirst, characterize the living organism as an experimenter of varying degrees of creative ability. So long as the impulse of a fundamental want is dominant, the response is characteristically "all-or-none" in type; but when the want is less imperious, or when different and perhaps conflicting wants supervene one upon another, the response becomes more varied and selective. The cautious approach towards an object which may turn out to be attractive or repellent—something to be devoured or refused, mastered or shunned—is an instinctive experiment that opens a way to education. Curiosity is, indeed, the basis of discovery and of learning, and while, regarded as an instinct, it is more an attitude of restraint than an "explicit definitized and localized action," it belongs, nevertheless, among the original propensities of living creatures. Thus a change can be quite as fundamental a want as is something to prey upon, The varied conflicts of life are resolved, not merely by "all-or-none" responses, but also by selective activities which combine and transform

one situation into another. The term "curiosity" will serve to characterize this instinct. In human beings immediate and clearly defined actions, so obvious in other forms of life, are frequently overlaid by cautious approach and experimentation before a decision is reached as to which of several responses shall be employed. The result of this behavior is to combine and fuse what is being done into something novel and as yet untried. This same attitude of cautious selection is also responsible for certain instincts, the dynamic patterns of which are nicely defined. Whatever may be the impulse—individual, social, or sexual—*acquisitiveness*, *constructiveness*, *adornment*, and *cleanliness* are examples of behavior closely related to primitive curiosity. A desire for change together with the cautious selection of a specific means conditioned by a definite and recurring situation may be regarded as the source of these four instincts.

§ 17. *Acquisitiveness*

Of this behavior Miss Whitley writes as follows:

There seems to be a very deep-seated tendency in the human race to hoard. In common with the magpie, the squirrel, and the bear, children manifest a proclivity to help themselves to attractive, portable articles, to store them away, and later to visit the repository, contemplate, manipulate, and enjoy the contents. Undirected, this tendency may become dissipated in harmless and useless ways; misdirected, it may become a social nuisance; wisely directed it may serve to further scientific knowledge and to bring æsthetic pleasure to thousands.

At first, developing from noticing and grasping, a young child

simply picks up an attractive object and finds delight in holding it, or keeping it near by till his attention is distracted. By the time he is four years old, there is a joy in having a special, definite place in which to keep the treasures, and the further joy of turning over the collection, examining and handling it. Until the age of seven or eight, the objects collected are quite miscellaneous and of a trivial nature. The material easily found in the environment will determine what particular things are amassed. Pebbles, hen-feathers, buttons, marbles, scrap-pictures, bits of metal, pieces of ribbon are all welcomed if available.

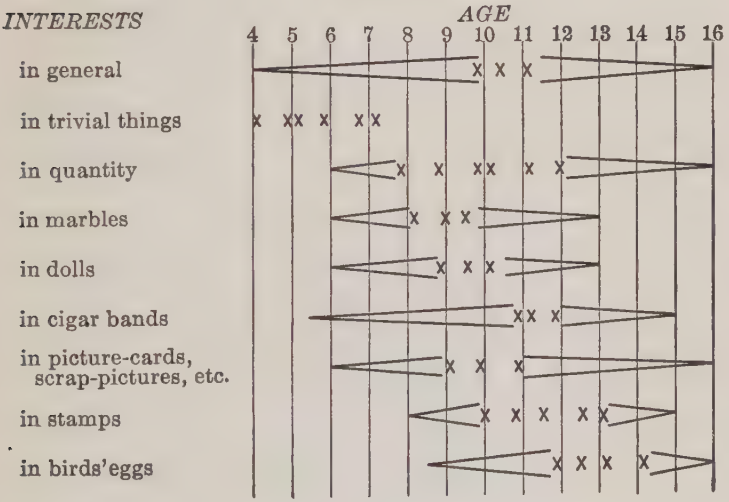
After the age of six or seven the social elements of imitation and competition begin to affect the collecting craze. A fashion may be set for shells, or paper dolls, or cigar bands, or little pictures. The child whom the others envy is the one who has the largest collection. From eight to twelve the fever seems to be at its height, over ninety per cent of children collecting something or other then, and frequently acquiring great stores of more than one kind of thing. Burk, in a study of California children's collections, points out age-periods of greatest interest, such as marbles from six to thirteen, but chiefly at eight and nine. Birds' eggs are interesting from nine on, but mostly between twelve and fourteen. Stamps hold the field from nine to fourteen or fifteen, after which the bored adolescent may present the too-little-appreciative small sister or brother with a well-filled stamp album. In the teens the sentimental factor is more dominant. Then it is that personal souvenirs are sought for—autographs, friendship symbols, dance programs, anything to remind the collector of the good times experienced or the personalities admired. The accompanying diagram shows the general age of waxing, height of attractiveness, and waning of several different interests: [1]

Acquisitiveness might be thought to be altogether a product of training and education, were it not for the fact

[1] Mary T. Whitley, "The Child's Instincts and Impulses," in *The Child: His Nature and His Needs* (The Children's Foundation, 1925), pp. 45 f.

that animals which clearly lack all such guidance likewise hoard. For instance, a squirrel which was taken into captivity immediately after birth, and reared thereafter in artificial surroundings, was nevertheless observed to develop the hoarding behavior with nuts, which were first offered to him after he had reached maturity. Although these

TABLE I



were the first nuts he had ever seen, he seized them and hid them in some more or less suitable place in the room, quite as he would do under natural conditions; furthermore, his movements betokened the act of digging a hole and covering each nut over with earth, although no hole could be dug in the hard floor, and there was no earth with which to conceal the hoard. Apparently nature provides such impulses; and although one must make certain reserva-

tions in the parallels one draws between man and lower animals, it is at least possible that the same fundamental types of behavior are manifest in both.

The reservations to which we allude should, however, be made more explicit. In the first place, an apparent likeness of behavior in man and in other animals may be entirely superficial, so that what strikes the eye as a direct parallel is in reality nothing of the kind. The squirrel, for instance, hoards as a part of its food-seeking behavior; and to separate this feature from the complexity of food-getting, eating, and then storing what cannot be eaten, is a questionable procedure. The child appears to show little interest in hoarding edibles, while animals rarely hoard anything else. The fact is that we do not yet know the precise nature of the appeal in either case, and we are only summarizing the empirical data in a superficial manner when we say that nature endows man and certain other animals with an acquisitive instinct. In the second place, we should bear in mind that an unquestionably instinctive behavior in lower forms of life need not be manifest in any recognizable form in the behavior of higher species. The general assumptions of evolution do not require that every primitive activity shall be preserved in all the higher stages of development; for *devolution*, or the degeneration of an endowment, must also be considered. While certain forms of behavior grow and develop, certain other forms weaken and decay. It is therefore quite possible that the same empirical results which one species

attains by instinct may in another be altogether a matter of acquired habit or voluntary choice.

But despite these reservations, we shall commit no serious error if we regard acquisitiveness as among the instincts. An interest in collecting is readily aroused in early childhood, and it is doubtful if any normal child ever escapes the impulse altogether. At the empirical level which we must at present employ in our work, this impulse, though ill-defined, will serve practically to direct the attention of both parent and teacher to a useful means of interesting children in the acquisition of true knowledge by leading them to organize the materials which they so spontaneously collect.

§ 18. *Constructiveness*

Here is another instinct, in some species of organism involving an elaborate procedure, the details of which could not possibly be acquired in the lifetime of the animal. The most fundamental form of construction is the building of a nest—an important feature in the life-cycle of many animals, and closely bound up with sex, and also, in some species, with social life in general. It is a curious fact that the most perfect nests are those constructed by lower forms, such as insects, and birds, whereas the higher animals in the main will seek their homes in places already suited to their needs—such as hollow trees, caves, etc. The anthropoid apes show a certain spontaneous interest in weaving grass, leafy branches, and other pliable material into a kind of rude circle in the midst of which

they will then contentedly squat.[1] The child, too, may at times evince a like desire to nest its bed-clothes, or encircle itself in leaves, hay, or sand. But no exact study has yet been made of this behavior.

What we usually have in mind when we speak of constructiveness is a native inclination to build things out of blocks of wood or stone, to shape things by a process of cutting or modeling, or to piece things together by gluing, sewing, or nailing. Yet all these activities are so largely determined by an artificial man-made environment that until we have made further experimental studies of the primates, including the human infant, it is well-nigh impossible to be at all sure whether or not any specialized behavior of an instinctive order is here involved. If we accept the general evolutionary scheme, we shall perhaps be obliged to conclude that the instinct of constructiveness, which directs a bird, reared in captivity, to build its nest of artificial materials, unaided, in precisely the form which characterizes its species, has become so degenerate in higher animals that they possess only a certain rudimentary interest in encircling themselves with a kind of crude barrier. Such a barrier, although it has no practical utility whatsoever, may still serve to fulfill an instinctive desire to be somehow inclosed. As for the finer manipulative acts of the primates, these are undoubtedly much more a matter of learning than a direction of instinct.

[1] Cf. Wolfgang Köhler, *The Mentality of Apes* (1925), pp. 94 f.

§ 19. *Adornment*

Adornment, in which nature seems to have extended herself in the provision of attractive costumes for so many of her creatures, finds its most instinctive expression as a method of self-assertion. Apart from all its important bearings as a sex-appeal and as a social factor, a certain increase in one's sense of individuality is made possible by ornaments, especially when they can be viewed or otherwise felt as personal attributes. The child's passion for "dressing up" is an instance of this desire for self-assertion; and a recent investigator has found that apes will deck their bodies with trailing rags, strings, and other appendages.[1]

While the effect of this primitive expression is soon overlaid in man by a variety of social implications, including the appeal of sex, the behavior is of undoubted importance as a manifestation of instinctive assertiveness, which makes an individual more important in his own eyes, quite apart from any effect this self-assertion may have upon others, or upon his surroundings. Furthermore, the close connection which adornment has from the beginning with an aggressive attitude makes it at once the foundation for masterfulness, bullying, sexual domination, etc.

The opposite inclination towards self-immolation, manifest in the protective camouflage of animals, is associated with avoidance and fear. But to seek submissively a kind of neutral and indifferent plainness is certainly quite as

[1] Wolfgang Köhler, *op. cit.*, p. 95.

"instinctive" as the contrary attitude and behavior which makes adornment a more conspicuous type of instinct.

§ 20. *Cleanliness*

The removing of dirt from the body is instinctive in many animal species, and probably also in man. The Peckhams, in their description of the behavior of wasps, thus describe the toilet of Urnaria, which followed her seizing and paralyzing a large caterpillar:

> Urnaria, probably feeling—as we certainly did—a reaction from the strain of the last few minutes, and a relief at the completion of her task, now rested from her labors. Alighting on the ground close by, she proceeded to smooth her body with her long hind legs, standing, in the meantime, almost on her head, with her abdomen directed upward. She then gave her face a thorough washing and rubbing with her first legs, and not until she had made a complete and satisfactory toilet did she return to the caterpillar.[1]

While some animals are more cleanly than others, it would be wrong to deny the instinct even in cases where the conditions of an animal's life are to our human taste quite disgusting. Apes, for instance, often smear their bodies with dung, and in captivity, at least, will eat their own excrement. Yet whenever, by chance, a foot or a part of the body gets soiled, they will invariably seek some means of removing the objectionable stuff without the direct application of their own hands. Thus, they will resort to a cloth or leaf in order to wipe off the offensive matter, or will scrape themselves on the ground or on walls, just as a human being does under like conditions.[2]

[1] *Wasps, Social and Solitary*, pp. 25 f. [2] Cf. Köhler, *op. cit.*, p. 83.

Since no directly comparable observations have yet been made upon children prior to the inevitable training which all receive in keeping the body clean, it may be difficult to prove that man's desire for cleanliness has the same instinctive basis that it seems to have in some other animals. But it is at least possible that certain forms of bodily cleanliness are spontaneously aroused, though it can hardly be supposed that the human infant is at all repelled by a wet or soiled napkin, provided no pain is suffered from its contact with the body.

We have now covered most of the individual traits which are advanced as instinctive forms of behavior, although we have left out of consideration many so-called instincts. Our aim has been illustrative rather than comprehensive, for the data of individual instincts are too crude and empirical to permit a comprehensive treatment of the subject. We have also found ourselves obliged to question the original nature of some of the instincts we have ventured to describe. Grasping, crawling, walking and swimming, eye-coördinations and blinking, migration and manipulation; these, and other types of behavior, are all ancillaries, in part innate and in part acquired, which, lacking the characteristic of a complete dynamic pattern with a desire at one end and a fulfillment at the other, make it more appropriate that we should consider their original nature in connection with acts of learning.

CHAPTER V

THE INSTINCTS OF SEX

§ 21. *Mating*

Passing now to the participative instincts which we call sexual and social, we have to do with the peculiar influence exerted by one creature upon another of its own kind. As thus broadly defined, social influence includes the attitude and the behavior of sexual attraction; yet it would probably be incorrect to speak of the instinct of sex as though it were a subsidiary form derived from the more general attitude and behavior of gregariousness, because many species are not markedly gregarious, whereas all higher forms of animal must mate for regeneration. But when we recall our derivation of instinct from an undifferentiated response of the "all-or-none" type, we see that it is unnecessary to assign priority to any one of the three types, individual, gregarious, or regenerative. Instead, it is far safer to accept the general proposition that both the integration and the differentiation which characterize each of these responses take place together, the particular species in its particular environment determining how much development and what special qualities of attitude and behavior shall be worked into the pattern of the instinct. Prior to all manifestations of sex and social influence there is a stage of development in which individuality and social

control are implicit rather than explicit, and it is only by maturation working in and through experience that the individual is thrown up, as it were, against the environment, to which it reacts. At the same time and in the same way, the environment separates itself into those influences which signify likeness of kind from those which signify alien or neutral influences. We must suppose, however, a special innate interest in the behavior of one's own kind—at least at the mating season among those members of a species that require conjugation for reproduction. But this interest before it becomes a specific attraction between individuals of opposite sex is vague and general.

Under the instincts of sex we may include the special behaviors of *mating* and of *parental care*. Mating is a seasonal behavior revealing the profound effects of physiological rhythms. These rhythms are especially noticeable in the female organism, which in the human species passes through a monthly cycle of susceptibility to sexual excitement. This physiological course is a product of maturation, appearing as it does for the first time at puberty—which in girls may vary from eleven to sixteen or seventeen years of age—and continuing until the climacterium is reached in late middle life. A corresponding development is found in boys, whose age at puberty is on the average a year later than that of girls. Men continue their virility longer than women their fecundity, but the seasonal susceptibility to sexual excitement is not pronounced in men, and there is no corresponding physiological cycle like that of menstruation.

§ 22. *Gradual and Saltatory Development*

The parental instinct will be considered in § 24. In the next two sections we may be permitted to introduce an excursus upon two aspects of instinct which find striking exemplification in the ripening of sex. These are (1) the apparently saltatory development of instinct, and (2) the correlative transitoriness of instinct.

The delay in ripening, and the rather sudden change which both boys and girls undergo in adolescence, have often led to the conclusion that instincts are transitory forms of behavior which appear suddenly at a certain level of development, and may thereafter disappear with equal suddenness. But it has been found difficult to maintain a saltatory theory, even on grounds so firm as those afforded by the facts of puberty; and it is equally difficult to suppose that an instinct should wane and disappear altogether after it has once made itself manifest.

Accordingly, recent investigators have been at pains to find antecedent behavior which should furnish, as it were, the roots of these growths; and likewise evidence of a late flowering even after the first fruits have been plucked. Against the saltatory theory, as applied to adolescence, it has been shown that the pre-adolescent is not unsexed, neither is it possible to detect the precise beginning or ending of those traits and interests which characterize the period of adolescence. On the other hand, a marked change does take place in adolescence, and the attraction of sex does wane in later life.

Although saltatory and gradual development seem to contradict each other, it will not be necessary to make a choice between them if our interpretation of instinct is made broad enough to embrace both. The original "all-or-none" type of response is an immediate affair called forth by conditions of the moment; it is impulsive, and may possess unique qualities of originality. So, too, in the case of more highly differentiated instincts; when the organism is ready for a certain action, and the situation is appropriate to its arousal, this action takes place without precedent and without warning. Thus the first mature manifestation of sex involves something new, and never before experienced. But it likewise involves much that is old and familiar—even habituated; for one cannot overlook the fact that in Watson's description of *love* as an original emotion and instinct of infancy, we find many antecedents of the pubescent manifestations of sex. The original sensitivity of erogenous zones of the body, and the conditions of tumescence, are the same factors which reappear in the mature act of sexual stimulation and response.

But how can the sexual act be at once a gradual and a saltatory development? The answer to this question is found, not in terms of the special factors described, such as sensitivity and tumescence, nor in the "feelings" of satisfaction which accompany the behavior of infancy and the behavior of adolescence, but in the patterns of the two types of behavior. Out of the one pattern generates the other, to be sure, and a genetic identity is discoverable

between them; but whenever the whole organism is impelled to respond in a new way, the newly generated pattern of behavior is unique and individual. The situation that confronts the adolescent is not altogether strange, neither are the responses of sex which are then carried out; yet the combination of the two affords at this time a pattern the complete fulfillment of which was not hitherto possible. The form behavior now takes is new and different from any previous manifestation, and it involves a step which is not a mere lengthening of a line already drawn, but a jump beyond the bounds of all previous experience.

We have selected the adolescent manifestation of sex as an illustration of this saltatory procedure in development because we find here the clearest evidence of a behavior, certainly innate, the mature and complete expression of which is long delayed in the human species. But the principle whereby we have endeavored to overcome the paradox of gradual and saltatory development is one that is generally applicable in all instinctive behavior, and indeed in all learning. While a genetic identity pursues every creature throughout its life-cycle, so that there is nothing it does or can do which is not somehow identical with what it has previously done, and what its ancestors have done before it, the fulfillment or completion of a pattern of behavior, whenever it occurs, is always a jump into the as yet unknown. The progress of evolution is therefore at once gradual and saltatory: gradual in so far as condi-

tions and susceptibilities slowly alter, so that the pattern of any form of behavior, once it is given, constantly integrates and differentiates its internal structure; yet saltatory whenever these conditions and susceptibilities of the organism permit and require the creation of a new form within the old, or perchance the replacement of the old. In the experience of the adolescent, the earlier vague and diffuse expressions of sex, which involve the whole organism more or less, leading to the harmless though never quite definite satisfaction that quiets the tired or suffering infant, suddenly finds a new focus about which the behavior becomes organized and expressive in a new and startling way. Even in adult experience, this distinction between the earlier and the later manifestations of sex continues. All human beings are at times susceptive to the quieting effects of fondling by a loved one; and this more or less undifferentiated behavior is the same in an adult as it is in a child. But the more definite appeal of sex, with the behavior that accompanies it, is something different, with a pattern of its own, instinctively determined and defined, though subject to manifold elaborations through the acquisitions of learning.

§ 23. *The Transitoriness of Instinct*

The transitoriness of instinct, which is also suggested by the waning and disappearance of virility in man and of fecundity in woman, presents the same paradox. The partial components of sex-experience and behavior, as they

are distinguished and practiced habitually and voluntarily, persist throughout life; whereas the normal pattern of sexual behavior which matures with adolescence disappears in old age, leaving in its trail a tame desire that can be satisfied only by artificial means or by the more primitive and diffuse behavior of childhood.

But, one may ask, is not this new and transitory creation properly described as learning rather than as instinct? The answer is both yes and no. Yes, in that every new creation, every step taken from one form of behavior to another, is indeed an act of learning; no, inasmuch as the step in question is conditioned not by experience but by maturation. The paradox is created by the formal logic which controls our words and other means of expression. For bio-logic, however, there is no paradox. Instinct and learning are but two aspects of the same life-process. Some of the conditions of a new creation in behavior are furnished by the maturation of the body; these are instinctive: others are provided by the modifications attributable to environment; these are learned. But the two go hand in hand; for maturation is stimulated by conditions which permit exercise, and growth is delayed when such conditions are poor or lacking.

An experiment performed by Breed on the pecking of small grains by chicks will illustrate the relative influence of maturation and practice upon an act which is instinctive (or reflexive)—at least the chick pecks its way out of the

shell in which it hatches. As described by Watson,[1] one group of six chicks was presented with small grains from the second day. The number of correct reactions each chick made in successful striking, seizing, and swallowing in fifty attempts to take up the grain was noted, and the same routine repeated for twenty-five days. "Thus it was found that the average number of correct (complete) responses obtainable on the second day in one group was 10.3; on the third day, 28.3; on the seventh day, 38.3; on the sixteenth day, 43.2. Initial accuracy of the whole act is thus low, but the increase during the first few days of practice is enormous." For comparison, similar tests were made with three other groups of chicks which were prevented from pecking for three, four, and five days after hatching. Whereas the initial efficiency of chicks in these groups was as low as that of the chicks of the first group, their rate of improvement was so rapid that only two days of practice, as a rule, was necessary to bring them to the level of efficiency of normally reared chicks of their age. It would appear, then, that maturation does play a part distinct from exercise or practice; and if we were permitted to generalize upon this experiment, we might say that, other things being equal, the more mature an individual is the more ready he is to benefit by practice, though in the initial stage of his undertaking he is apt to be as lacking in efficiency as he would have been in a similar situation at less mature age.

[1] *Behavior* (1914), pp. 138 f.

With respect to their transitory nature we can say, in conclusion, that for many instincts there is a favorable moment when maturation coöperates with learning to a high degree. In so simple and original a response as pecking it is doubtful—though possible—that an initial delay would prove of any advantage in the final degree of proficiency which the act attains through the joint processes of maturation and practice. With other acts, such as those of sex, nest-building, and the care of the young, the favorable moment is delayed for some time after birth, and the instinctive behavior does not show itself with completeness until it appears as a result of maturation and an appropriate situation. When it does show itself, it is a unique performance, though further elaborations of technique are still possible. A new pattern of behavior has been formed which answers a new and more exacting impulse; and this behavior can be, and is, repeated whenever the impulse and the appropriate situation combine to reëstablish it. In course of time the impulse may weaken, and the form of the behavior become translated into other and surrogate forms, so that the original pattern is no longer vital and spontaneous as it once was. Indeed, the original pattern may vanish altogether, leaving but the shell of surrogate ideas and subsidiary responses which from time to time have been associated with it.

In this sense William James' dictum "Strike the iron while hot" [1] has its proper application to all educational

[1] *Psychology* (Briefer Course; 1893), p. 404.

methods and procedures. In so far as we are able to discover a spontaneous impulse and an instinctive pattern of response, we should make use of them when they appear, and under the conditions which determine their appearance. The danger of following this dictum too literally in the case of sex interests as they manifest themselves in adolesence is chiefly a result of the artificial conventions of our society, which provide external reasons for delaying the complete manifestations of sex beyond pubescence. Yet, though we must admit the necessity of curbing this dominant passion at a time when nature insistently demands freedom of expression, we cannot doubt that this exception to the rule is a major problem in the life of civilized man, and a problem which can never be successfully solved in terms of the instinct which is thus being thwarted. Instead, we are forced to exercise repression, and resort to surrogate forms of action, which have supplied the race both with its most poignant examples of poetry and art, and also with a large portion of its neurasthenics and mal-adjusted individuals.

This fundamental conflict between nature and nurture more than anything else has required man to turn from blind passion to the highest flights of imagination and thought. Yet, despite outlets through sublimation of desires, the human race in its civilized state is forced to bear a burden for which many of its members are quite unfit. Although the imperious demands of sex must be checked, the desire is still present, and with it the education of adolescence must constantly deal.

§ 24. *The Parental Instinct*

We return now to the second main aspect of sex, which is called the *parental instinct.* A solicitude for the young manifests itself in a manner that varies in different species of organism, from those that make all provision before the advent of their offspring, to those which lavish years of patient care upon the infant and child. In a certain sense parental care and home-building are but two aspects of one instinct. But this connection only shows again the artificial nature of any distinction we may draw in an attempt to clarify original forms of behavior. Yet the distinction is useful for certain purposes, because parental care is always a social, whereas home-building may be an individual, response. The object of solicitude is normally a creature of one's own kind, and usually one's own child. Not only is the behavior a response of sex, but it manifests itself differently in the male and in the female. The parental instinct is stronger in the female, and exhibits more explicit forms of behavior, among which in mammals the chief is lactation. In addition, there appear certain general and undifferentiated forms of behavior, such as those of infantile love, which are reciprocally enjoyed by the parent, and which thus may perhaps be said to lay a foundation for all animal sympathy. The contact of mother and child is certainly one of the most intimate of relations, while the care exercised by the mother—and sometimes by the father—over the helpless infant furnishes a sort of prototype of social organization under leadership. It is commonly

maintained by ethnologists that the family group is the first among social organizations, and family life is obviously organized under parental leadership.

But one should not neglect the equally reciprocal relation of mating, which involves a certain dominance of the male over the female—though not so clearly or so inevitably as the dominance of parent over child. Indeed, one might perhaps regard mating, in contrast with parental care and control, as being the prototype of social cohesion based upon the reciprocal reaction of one individual to another. Family life would then indicate the originals both of leadership in a group, and also of the sympathetic cohesion which is manifest in the leaderless society. These topics will be considered in the following chapter.

Before proceeding, however, with the discussion of gregariousness, we may summarize what has been written upon the sex instincts by saying that the original undifferentiated response of love or contentment, as described by Watson in the behavior of infancy, differentiates itself by processes of maturation and learning into two forms, namely, mating and parental care. Both operate within the general pattern of likeness of kind, though they often express themselves otherwise when the urge is dominant and an appropriate object is lacking. Hence we find, occasionally, perverse forms of mating in the expression of sex, and parental care and solicitude lavished upon any weak or dependent creature. Human beings, at least, will create with the aid of imagination an objective more or less suited to the demands

of these instincts; the parental instinct, for instance, is quite obvious in children's play with dolls. If mating is less characteristic of early childhood, that is because the desire for a mate is not evinced until puberty. But long before this time the child has learned the significance of those social relations between individuals which are determined not by sex but by the more general dictations of the herd-instinct.

CHAPTER VI

SOCIAL INSTINCTS

§ 25. *Communism*

The reciprocal interest among the members of a species which leads to the behavior of social groups is, in its primitive state, quite the opposite of an individual response to an objective, and need have none of the features of sexual attraction or parental solicitude. Instead, the individual is submerged in the undifferentiated setting of group-behavior, the influence of one member upon another being altogether too immediate for any reflection or for the independence of an individual agency.

Rivers calls this instinctive social influence *suggestion;* and he describes its operation in the following passage which we can well afford to quote at length:

> Assuming that animals whose common action is thus determined possess something we call mind, the effect of suggestion is to produce in all the members of the group a mental content so similar that all act with complete harmony towards some common end. There is reason to believe that the harmony so produced is more complete than is ever produced by the common possession of an idea or other form of intellectual motive. It is no great assumption that the more gregarious is a species of animal, the more perfect is its gregarious instinct. Since Man is very far from being completely adapted to the gregarious

life, it will follow that the harmony produced by the action of suggestion in fully gregarious animals is more complete than is ever produced in Man, either by suggestion or by the presence in the social group of a common idea or other form of intellectual motive.

There is reason to believe that this superiority of the unwitting process of suggestion over intellectual process remains good among the different varieties of Man. Existing families of Mankind differ greatly in their degree of gregariousness, and with this there seem to go different degrees in the potency of suggestion as a means of producing uniformity of social action. Thus, the Melanesian is distinctly more gregarious than the average European. His whole social system is on a communistic basis, and communistic principles work throughout the whole of his society with a harmony which is only present in certain aspects of the activity of our own society, and even there the harmony is less complete than in Melanesia. As an example of such harmony I give the following experience. When in the Solomon Islands in 1908 with Mr. A. M. Hocart we spent some time in a schooner visiting different parts of the island of Vella Lavella. Whenever we were going ashore five of the crew would row us in the whale-boat, four rowing and the fifth taking the steer-oar. As soon as we announced our intention to go ashore, five of the crew would at once separate from the rest and man the boat; one would go to the steer-oar and the others to the four thwarts. Never once was there any sign of disagreement or doubt which of the ship's company should man the boat, nor was there ever any hesitation who should take the steer-oar, though, at any rate according to our ideas, the coxswain had a far easier and more interesting task than the rest. It is possible that there was some understanding by which the members of the crew arranged who should undertake the different kinds of work, but we could discover no evidence whatever of any such arrangement. The harmony seems to have been due to such delicacy of social

adjustment that the intention of five of the members of the crew to man the boat and of one to take the steer-oar was at once intuited by the rest. Such an explanation of the harmony is in agreement with many other aspects of the social behavior of Melanesian or other lowly peoples. When studying the warfare of the people of the Western Solomons I was unable to discover any evidence of definite leadership. When a boat reached the scene of a head-hunting foray, there was no regulation who should lead the way. It seemed as if the first man who got out of the boat or chose to lead the way was followed without question. Again, in the councils of such people there is no voting or other means of taking the opinion of the body. The people seem to recognize instinctively, using this much misused word in the strict sense, that some definite line of action shall be taken. Those who have lived among savage or barbarous peoples in several parts of the world have related how they have attended native councils where matters in which they were interested were being discussed. When after a time the English observer has found that the people were discussing some wholly different topic, and has inquired when they were going to decide the question in which he was interested, he has been told that it had already been decided and that they had passed to other business. The decision had been made with none of the processes by which our councils or committees decide disputed points. The members of the council have become aware at a certain point that they are in agreement, and it was not necessary to bring the agreement explicitly to notice.

I am aware that the explanation of these examples of the great harmony of social life in savage peoples as due to suggestion rests upon evidence of doubtful value, and might be explained on other lines if our knowledge of the people, their language and behavior, were more complete. It may be noticed, however, that this explanation has much to support it in our own society. The examples I have given are similar to the so-called

process of thought-reading among ourselves.[1] It is noteworthy that these processes are especially exemplified in the minor everyday behavior of our community, behavior comparable in some measure with the harmony of the boat's crew which so excited my wonder in Melanesia. A speculative Melanesian who watched the traffic in the streets of a great English town would be greatly struck by the harmony of the passage of people on the pavements in which the rarity of jostling is to be explained by an immediate intuition of the movements of others which takes place unwittingly with all the signs characteristic of instinctive behavior. In the case of the roadway, the Melanesian would on inquiry learn the existence of definite regulations, but they would seem to afford insufficient explanation of the harmony of the traffic and the rarity of collisions. These examples are peculiarly appropriate to the present argument in that they have a definite relation to the welfare of the group and, at any rate in the case of the roadway, promote its safety as well as its comfort.[2]

This significant discussion of gregariousness, while based upon empirical data, leaves but little doubt in our minds as to the author's ascription of leaderless communistic action to instinct. Whether, indeed, a thoroughgoing communism, such as seems to prevail among the Melanesians, is the prototype of all social organization, or whether it is but one of two possible types, the led and the leaderless group, either of which may develop in a way to dominate over the other, is a question we shall not try to answer; but the original influence of suggestion, sympathy, intuition, or whatever one may please to call it, can hardly be doubted.

[1] I use "thought-reading" as a name for the unwitting transmission of ideas from person to person in the presence of one another, as distinguished from the problematical telepathy or distant thought-transference. (Rivers' note.)

[2] *Instinct and the Unconscious*, pp. 94 f.

This conclusion also agrees fully with the derivation of all behavior from an original undifferentiated matrix in which the individual has not yet definitely emerged from his environment.

But it is important to note that communistic behavior is not identical with the primitive "all-or-none" reaction. On the contrary, leaderless activity may be very finely organized, as the actions of the Melanesian boatmen clearly prove. So, too, may be the communistic behavior of bees and ants. Each behavior shows the result of a long and perhaps arduous developmental process, whether in the phylogeny of insects, or in the ontogeny of human beings. This, indeed, is the reason why we cannot be sure that a thoroughgoing communism is in a true sense any more primitive than a highly individualistic society. It may well be that communism is consistent with otherwise primitive conditions of life in a way in which individual anarchy is not; but among animals we find both social and solitary species; and even in man the individualism which we associate with civilization and culture has never been able to free itself quite from the inherent demands and interests of the group. In attempting to interpret and improve human life, whether in the nursery, the playground, the school, the town, the state, or the world at large, it is well to remember that we are dealing with impulses at once individual and social, from neither of which can we ever free ourselves entirely. Just as in the embryonic development of Amblystoma (see pp. 23 f.) the integration of the originally diffuse "total-response" is paralleled by "a progressive individua-

tion of particular reflex-circuits," so the integration of a social group is paralleled by the individuation of its members. In the measure in which the one or the other process dominates in the result we have either leaderless communism, or a hierarchy of individual leaders.

§ 26. *Leadership*

While suggestion is one means whereby a primitive social organization is effected, it is not the only means. "The Law of the Jungle," based upon the individual instincts of *anger* and *fear*, prescribes a social hierarchy in which every member, excepting the ones at top and bottom, submits to his superiors and tyrannizes over his inferiors. An illuminating example of primitive leadership in chickens has been found by a Norwegian investigator who studied the behavior of these fowls during a period extending over ten years.[1] Every flock of hens (or of cocks) exhibits a definite hierarchy of leaders, and whenever a new hen is admitted to the flock she must accept such a place as she is able to maintain. Expressions of dominance and submission are most noticeable at the time of feeding when each fowl is motivated to get as much food as she can. If two hens make after the same kernel of grain, the inferior hen must give way to the superior. If she resists, she is severely pecked, and if she pecks back she must give battle until

[1] Cf. Thorlief Schjelderup-Ebbe, "Beiträge zur Sozialpsychologie des Haushuhns," and David Katz, "Tierpsychologie und Soziologie des Menschen," *Zeitschrift für Psychologie*, 1922, *88*, pp. 225 f.; also Schjelderup-Ebbe, "Fortgesetzte biologische Beobachtungen des *Gallus domesticus*," *Psychologische Forschung*, 1924, *5*, pp. 343 f.

one or the other is victorious. No ambiguity can remain in the rank-order of the flock; each fowl must hold her place, or fight for a better one. The rank-order is determined not only by the aggressiveness of anger but also by the submissiveness of fear. A pullet's submission to a hen may continue long after she is grown and has become the more powerful of the two. Furthermore, the conditions of an encounter may favor a display of aggression by one fowl and a display of fear by the other, which often determines their ranking without recourse to the test of battle. It thus happens that although each fowl has her rank, which permits her to peck certain fowls, and forces her to submit to the pecking of others, the order of precedence is not always regular. Fowl *A* may tyrannize over *B*, and *B* over *C*, whereas *C* tyrannizes over *A*. "Triangles" and "squares" of this sort are to be found in most groups, although many of the fowls rank themselves in a line from superiority to inferiority.

Similar hierarchies are not uncommon in groups of children who play together. Despite the different kinds of superiority which manifest themselves in different ways, so that the leader in the classroom may be obliged to submit to the bully on the playground, there are certain fundamental attitudes of mastery and submission which children assume towards one another, and which even adults are slow to overcome. In one of his clever essays, Max Beerbohm divides human beings into two classes, "hosts" and "guests"; and there is a certain truth in this division.

It appears, therefore, that in the social life of the poultry-yard, where instinct may be thought to play a larger rôle than experience, the unified group-action of Rivers' Melanesians finds no obvious counterpart. Instead, the struggle for existence is both constant and severe, a hierarchy of leadership being wrought out by means of aggression and submission. In determining this hierarchy physical strength is the important factor. It is not the only factor, however, for a strong hen may be cowardly, and a weak one courageous. Our investigator finds that an aggressive attitude is often sufficient to win leadership, while a submissive attitude may impose upon a timid fowl a position lower than her strength would entitle her to command. Furthermore, the attitude varies from time to time, just as it will in human beings where varying circumstances provoke now anger and aggression, now fear and submission. But an aggressive attitude coupled with a weak body will scarcely enable a fowl to maintain leadership; because when challenged to give battle she will usually suffer defeat. Seniority, however, sometimes enables a hen to hold her despotism after age has impaired her capacity to fight. Thus physical strength is merely the underlying condition of a fowl's status in the group, her attitude of aggression or of submission, and her relative seniority being the determining factors. The existence of "triangles" and "squares" is attributable to these variables. Similar complications in leadership are not uncommon among men. In a family or in a business organization the rank-order of members

is often quite definite; yet *A*, who submits to *B*, his older brother, may lord it over *C*, an acquaintance who is also *A's* chief in business.

While both communism and a hierarchy of leaders appear to be equally instinctive in origin, it can perhaps be said that neither a thoroughgoing leaderless communism, on the one hand, nor a completely individualized anarchy, on the other, can satisfy the demands nature imposes: the first, because it permits too little scope for the development of intelligence, and the second, because it denies the cravings for sympathetic contact and the manifold feelings of kind. It should be observed, however, that the refinements of adjustment requisite to a communistic life are not altogether, and in man, at least, are to a very slight degree, the product of mere instinctive action. One learns the refinements of sympathetic adjustment just as truly as one learns to separate oneself and stand aloof in a crowd. But whereas to learn sympathetic behavior is to increase one's susceptibility to fine shadings of situation and response in terms of *bio-logic*, the acquisition of executive control and the submission to rules and regulations can be acquired by formal logic. At least we know more of the latter than we do of the former, and that is why education is often so one-sided in its procedure.

§ 27. *Integration*

There are two different conceptions of society. According to one of them a society consists of members which are

"integrals" of the group. According to the other conception society consists of separate "integers," each a self-sufficient individual. In the first conception the group-whole is more significant than the individuals that compose it; whereas in the second the group, being constituted of individuals, is less significant than its members.[1] In choosing the first of these two conceptions we maintain that a social group determines its members, each of whom will possess whatever degree of individuality the particular group makes possible. We therefore deny the opposite view that society accrues to individuals in congregation, and is, in effect, simply the sum of several distinct entities. Social integration is not a summation of "integers"; instead, the members of a social group are the "integrals" of a whole. In other words, priority attaches to the group, not to its members.

Let us not, however, fall into the old controversy over the priority of whole and part—which comes first, the hen or the egg—because this argument puts the matter in a false light. When we say a whole is prior to its members, we should not forget that wholes are individuals, and that a generic whole embraces both the hen and the egg. A social group, the members of which are not yet individuated, is like a cell with its numerous microscopic divisions, each of which is to some extent individuated by the surface-tension and cleavage which marks it off from its neighbors,

[1] Cf. the writer's article, "Crossing 'the Rubicon Between Mechanism and Life,'" *Journal of Philosophy*, 1925, *22*, pp. 288 f.

but less so than a complete cell. Again, the multicellular coöperation within the organism as a whole—if it be a multicelled creature—is obviously greater, and affords less opportunity for the individuation of a single cell than is to be found in the relations of one organism to another as they make up a species or a communal group. In a genetic series a "whole" is always more individual than its members; but when the context is shifted these same members may become more individual than the whole from which they derive. Thus a cell is more individual than its protoplasmic divisions, and an animal is more individual than its organs and limbs; but the cell from which an animal grows is less individual than the animal. Individuality accrues to any body or any thing possessed of a degree of articulateness sufficient to define it and set it off from its surroundings; yet different degrees of articulateness determine different degrees of individuality.

This, then, is what we mean when we speak of integration: Whatever is integrated constitutes a "whole," the integers, units, or "elements" of which are discoverable only in terms of aspects, attributes, or variable phases of the whole. In other words, integration is articulateness or "wholeness," as distinct from inarticulateness or diffusion. In a different and more restricted context the members of larger "wholes" may articulate and form smaller "wholes" by virtue of their subordinate aspects or members. But whether "large" or "small," wholes are of varying articulateness; some are "good" wholes, stable and highly

articulate, while others are less good, less stable, less articulate.

These inferences are drawn from *bio-logic*, that is, from the principle of genetic identity, which leaves the hen and the egg, despite many transformations, one and the same being, because of their derivation from a common source. So, too, in social instincts the individual is always moved as a member of the group; but, whereas individual action has for its context the less articulate ground of all other individuals and things upon which the single organism reacts, a social action is a group action, which includes in its articulate pattern other organisms of the same kind reacting as members of the group to an objective, in a context less articulate than the group that takes action. The members of a social group are all more or less individuated. In the behavior of hens at feeding, individuation is marked. Under other conditions, the compelling impulse of group-action submerges the individual for the time being in the more highly articulate membership of the flock; this can be observed in the migratory flight of birds, where, without express leadership, the flock behaves under the influence of suggestion like the Melanesian boatmen of Rivers.

A change of this kind in the seasonal behavior of certain birds has been clearly demonstrated by the observations of Eliot Howard,[1] who finds that in the springtime each male bird separates himself from the flock in order to secure a territory into which he may later attract a mate. This

[1] *Territory in Bird Life* (1920).

territory, in which the nest is to be built, he defends against all other birds until the female arrives, and the pair will continue to defend it throughout the breeding-season. But in the autumn hostility ceases and the birds return to their flocks.

> In winter . . . the individual loses its individuality and is subordinated to the welfare of the community, whilst in spring it regains its individuality, and all its inherited instincts which then come into operation lead to its isolation from the flock.[1]

But although individualism and gregariousness are opposite impulses which manifest themselves quite differently under different conditions, a general mode of individualism or gregariousness still embraces the possibility of both kinds of behavior. The details of these varying responses, as they focalize in leadership and are communicated from one member of a group to another by means of suggestion or reasoning, are the subject of *social psychology*. In this chapter we have tried to explain the instinctive impulses upon which a social psychology must rest.

[1] *Op. cit.*, pp. 269 f.

CHAPTER VII

IMITATION AND PLAY

§ 28. *Imitation*

Imitation is closely allied to group-behavior; for it occurs usually, though not exclusively, among the members of a social group. The question of instinctive imitation has led to endless controversy. The problem may be stated in the following way.[1] Assuming instinctive behavior, in which a definitely patterned situation calls forth an equally definite response, can the same response be obtained from merely witnessing this behavior on the part of another? For instance, can instinctive rage be aroused not only by a menacing situation but also by witnessing the rage of another when oneself is not menaced?

While no one doubts the importance of a model in learning, instinctive imitation requires what McDougall has called a "special adaptation of the receptive side of each of the principal instinctive dispositions, an adaptation that renders each instinct capable of being excited on the perception of the bodily expressions of the excitement of the same instinct in other persons." [2] Accordingly, not only the objective which normally creates the situation of instinctive action, but also the perception of that action by another,

[1] Cf. Koffka, *op. cit.*, pp. 306 f.

[2] William McDougall, *Social Psychology* (8th ed.), p. 95.

is found capable of touching off the appropriate response. This is obviously a difficult conception, because it seems to vary radically from the normal course of instinctive behavior with its beginning and end; for no true objective is present to the imitator, but only the perception of the other's response.

However, it is not alone on theoretical grounds that an instinct of imitation has been attacked; the exact observation of animals, and of children, has revealed much less of imitation than was formerly assumed. Monkeys and apes, in particular, which are commonly thought of as imitative creatures, are found to be quite unobservant of, and unaffected by, the precise behavior of their fellows. In most instances where a case for imitation can be made out, the effect may be attributed to the interest aroused in the behavior of another member of the species by reason of gregariousness, or by the modifications of the situation introduced by the other's presence, rather than by anything that can properly be called a direct imitation of the other's action. Briefly stated, animals can, and to some extent do, learn by imitation, whereas only to a very slight extent can they or do they imitate one another "instinctively."

And yet, despite this adverse criticism, the possibility of exciting an instinctive response by some other means than the usual "beginning-situation" is not theoretically unsound; nor are higher animals altogether lacking in evidence of this kind of behavior. As for the evidence, although it can be safely affirmed that an original imitativeness has

been greatly exaggerated by those who, like Tarde,[1] have been inclined to base their entire social psychology upon it, the fact remains that certain crude and undifferentiated patterns of instinctive response can be set off by the perception of another in the act. Thus, infants will smile when smiled at, and frown when frowned at. Children and apes can be made to stare in a certain direction when one of their number or an adult human being stares in this direction. Actions involving the general posture and locomotion of the body, such as rising, stooping, or bending forwards, the crude behavior of attraction and avoidance, reaching, grasping, running towards, running away from, facial grimaces of repulsion, and many of the general types of vocalization, such as shrieking, wailing, crying, cooing, gurgling, and even more precise forms of utterance, are all capable of arousal under favorable conditions by the mere presence of a model.

And now as to the theory of imitation: the adverse argument holds only when instinctive actions are regarded as a chain of simpler and more "elementary" units. When the course of action is taken to be an association of separate acts linked together in a certain sequence, then, indeed, the possibility of arousing this behavior in any other way than by the specific beginning-situation—which is the perception of an objective to be attained—seems an absurdity. At best, we might think it possible to tap the instinct somewhere in the middle of its course, and thus secure the

[1] Cf. *Les Lois de l'Imitation* (1904).

behavior which would be sequential from that point onwards. But the facts do not bear us out in assuming a behavior of this type. Furthermore, we have already had occasion to deny the premises of any such conception; instead, we have insisted that every act must be regarded as a whole, the pattern of which, including its beginning and its end, is held together by a cohesion quite different from one that can be thought of in terms of a mere association or linkage of separate and discrete acts. Indeed, the very objective is created and defined as the behavior progresses, and the "situation" of an instinct is not a *being* but a *becoming*. With this interpretation it is no longer difficult to understand how something other than the specific "beginning situation"—the menace or restraint that provokes rage and fighting, the strange or unusual that provokes fear and flight, or the objective at which one happens to be gazing intently—should arouse the same instinctive mode of response in others. The question is, rather, why imitative action is limited to more or less crude and undifferentiated responses; why it does not extend to manipulation and construction.

The answer, again, must be given in terms of the pattern of behavior. The elaborately detailed manipulations of higher animals are not instinctive but learned; this means that the details must be worked out in terms of graduated likeness and difference within the crude impulse that leads onward persistently with varied effort until an end is attained. All that imitation can do in an original situation

is to provide an impulse to feed when others are feeding, to move when others are moving, to mate when others are mating; but it cannot control the specific details of responses that must first be learned and practiced before they can be performed. Even simple learned responses are imitated with difficulty; for when one tries to imitate what one can do otherwise without effort, the situation is altered; and in altering the situation the pattern of an acquired act, being less firmly established than the pattern of an act with which one is endowed, is easily shattered.

It may perhaps be objected that the elaborate instincts of lower animals—especially the insects—would seem to provide instances of a technique which is manifest with a high degree of perfection the first time certain acts are performed, and yet these unlearned acts are not imitated by other members of the species. But here we have a different situation. The technique of an insect's behavior is by no means so precise as it is sometimes thought to be; neither is an insect altogether lacking in "experience" when the time comes for nesting, and the important functions of making preparations for its offspring. As the Peckhams have observed and recorded in the passage quoted (p. 44), after bursting from the cocoon, insects "are hourly acquiring experience, so that when the cares of life descend upon them, they are no longer creatures of mere instinct." The conditions of the life-cycle do not provide appropriate opportunity for the expression of imitation, nor are the acts which might be imitated technically

perfect in detail. Both experience and the conditions peculiar to the individual organism in its immediate environment determine just what it shall do and just how it shall do it.

It therefore appears that an original form of imitation is possible only with respect to crude patterns of behavior in which the assimilative character of the whole is the dominant feature alike of the situation and of the response. Thus, and thus only, can an instinct be made to function by some other means of arousal than that of the specific beginning-situation. An individual may be enraged, or frightened, or moved to tears or laughter by witnessing those behaviors in another, as well as by a specific objective, because the formal pattern which affects him in each of these instances is a *complete whole*, and not a succession of events. But the particular technique of the behavior called forth in each case is not imitated except by a special intention based upon previous experience, or by the discovery of a new way of acting.

It is an undifferentiated rage that seizes upon one as he observes another in a fight; and, while he may itch to fight himself, he does not imitate the special acts of the other's pugilistic display. So, too, in the simple imitation of a yawn, it is not the particular action of the other's jaws which is imitated, but yawning in a generic sense; one yawns in one's own way. So in all other forms of immediate imitative response, one does what one can in a situation which touches off an innate form of behavior be-

cause the situation in question is a real member of that behavior. In this sense, imitation, although it is not the key to all learning, or the basis of all social behavior, is a fact of profound significance; because it shows us that the original matrix, out of which all undifferentiated forms of response must arise, *includes* both the situation and the response. Furthermore, a human being becomes more and more like the things that affect or move him. Indeed, the terms "adaptation" and "adjustment," which are so frequent in educational discussions, signify just this original imitativeness. We liken ourselves to our surroundings and find in our environment those things which fit or conform to our own modes of apprehension and response. The differentiation that sets off the objective from the responding organism—the perception from the reaction, the affect from the effect, the individual self from the rest of the world, together with all special interests in and responses to the members of one's own kind—is a product of experience and learning.

Instead of accepting an instinct of imitation we are led back to more primordial things—to the matrix of behavior in the "all-or-none" response. An original imitativeness there is, to be sure, but not a specialized type of innate behavior such as is manifest in the individual, the sexual, and the social instincts which we have been discussing. Yet imitation occurs in all of these forms, because whatever one does by imitation, without learning, must be done by way of one or other of the instinctive modes described.

§ 29. *Play*

Although less social in its implications than imitation, play bears a similar relation to instinct, because both express themselves in various forms of instinctive behavior. A young child exhibits all the special forms of individual, sexual, and social instinct playfully as well as earnestly. The difference is mainly one of attitude; and it is the preservation and cultivation of this attitude that makes it possible for a mature person to play with things that have no immediate instinctive appeal. Since the attitude of play manifests itself long before a child is able to distinguish between earnest and playful endeavor, we must consider it among the original dispositions of man.

Like imitation, play commands no unique patterns of behavior. A child will fight, hunt, cuddle a doll, show proclivities for mating and communing with others, collect objects, construct a nest or a house, adorn itself, cleanse itself, assert itself or submit to leadership, flee, hide, and repulse disagreeable things—in a word, will run the gamut of instinctive behavior without ever undertaking one of these acts seriously or persistently. It is as though the innate patterns of behavior offered so slight a resistence to the superabundant energy of childhood that, instead of aimless reactions or quiescence, the child plays whenever it is not forced to seek an adjustment to some compelling situation. Assuming a large amount of surplus energy in childhood, it is obvious that some way must be found to give it expression. The existence of predetermined forms

of response furnishes a diversified means of expending this energy. Furthermore, it is highly interesting to be doing things which take form in the doing, especially when one is not held responsible for the outcome. "Let the wind blow where it listeth" is the maxim of childhood; yet this maxim is not a result of deliberation, but the expression of a natural disposition to take things as they are and permit oneself to be borne along with the current of events.

As Koffka has observed, a child will dress a stick and treat it with loving care as a "dear baby," but when the situation has altered, the same stick will be cast into the fire without the slightest compunction.[1] There is no coherence among the child's various acts as they succeed one another—sometimes with startling rapidity—because the child's mind is "pockety," and a sudden change from one pocket to another brings no sense of incongruity or contradiction. This lack of continuity, together with an element of surprise that accompanies every new turn of affairs, lends a constant interest to the succession of events which shape themselves in playful moods of seeking and avoiding, asserting and submitting.

Not only does play offer a means of expending surplus energy, which is the well-known theory associated with the names of Herbert Spencer and the poet Schiller, but, as Karl Groos has pointed out,[2] play also affords opportunity for developing the technique of instinctive responses, and

[1] *The Growth of the Mind*, p. 346.

[2] Cf. *The Play of Animals* (1898), and *The Play of Man* (1901).

for acquiring other, more precise and advantageous, means of behavior. The higher the position occupied by a species of animals, the more playful are its members. Thus man is the most playful of all animals, and his period of infancy is longest. Indeed, the chief reason why the instincts of man are so ill-defined is that for the most part they are heavily overlaid with acquisitions made in play. This is especially true of the group of instincts we have classified as derivations from *curiosity*. *Acquisitiveness*, *constructiveness*, *adornment*, and *cleanliness*, each finds frequent occasion for playful exercise, leading both to an improvement of technique and to habitual methods of performance. In a previous section (p. 56) it was noted that puppies fight in play yet refrain from biting one another. There can be no doubt that the dog vastly improves the technique of his fighting by playful exercise while a puppy.

The advantage of playful behavior as a preparation for later life is therefore considerable. But it would be educationally unsound to begin with play; for this only leads to what is known as "soft pedagogy." Learning, as we shall have occasion to see later on, is a serious undertaking, and to try to inject it into a playful situation is to destroy play and limit the child's freedom of expression without accomplishing any serviceable end. The same modes of instinctive behavior that can be performed playfully are also performed seriously and it is to their serious aspect as fundamental ways of *working* rather than of *playing* that the educator should direct his attention. Education is

work, and work is compulsory; but when play is made complusory it ceases to be play. Failure to differentiate the attitudes of play and work is responsible for a great deal of the dislike for school which many children evince. With the best of intentions a teacher can thoroughly spoil a child's happy and spontaneous interest in playful pursuits by trying to insinuate study into them, or by exercising an injudicious control over them. The adult does not belong in the child's world. Among the first things a child learns from his contact with adults is that he must be submissive; and submission to compulsion is inimical to play. For this reason, as Koffka has pointed out,[1] the child creates a world of his own, running parallel to the adult's world in which he is washed and dressed, put to bed, and made to keep quiet. Relief from this compulsory routine is sought in play where things take their own course and are subject to all kinds of curiously interesting changes and inconsistencies, quite unlike the teacher's or the parent's orderly ways of doing things.

In time, of course, the child must relinquish his play-world and enter more and more fully into the adult's world of compulsion. This transition, while it is not made without a certain resistence, is not "unnatural" to the child; because the same instincts which hitherto have been exercised in play are now exercised seriously in work. But until he is ready for this step, to smuggle work into play is to limit the child's horizon and to annul the spontaneous

[1] *The Growth of the Mind*, Ch. VI.

enjoyment which he takes in living. Unless he is given a chance to exercise his instincts playfully, as well as seriously, a child will lack the foundation for a later cultivation of leisure, by means of which he can retain throughout life an æsthetic appreciation of the intrinsic value of things. In addition, then, to the educational advantages of play which accrue involuntarily to the player, there is also a *functional enjoyment* in doing things without compulsion. And this, perhaps, is more significant than either the expression of surplus energy upon which the Schiller-Spencer theory rests, or the preparatory value of play upon which Groos has based his theory.

§ 30. *Summary of Instinct*

We have discussed the problem of human instincts realizing that our data were largely empirical and our definitions highly tentative. Yet certain characteristics of original modes of behavior are clear enough to serve as guides in education, and it is these we wish to stress in summarizing the subject.

The most original mode of behavior appears to be an "all-or-none" type; that is to say, a primitive organism is completely engaged in behaving in one way or another. Broadly speaking, these ways are two: the way of attraction, and the way of avoidance. The so-called *tropisms* belong in this category. But although a primitive response involves the participation of the entire organism, it is not ungraded. On the contrary, every response seems to in-

volve what Professor Child calls a "physiological gradient," the maximum rate of change occurring in the "head-region" of the organism and falling off gradually, perhaps to rise again in the "tail-region" where the dominance of the head is no longer potent. In other words, the excitation as it proceeds from head to tail suffers a decrement of intensity which may allow a new focus of excitation to initiate and control a secondary and inhibitory response. Movements both positive and negative, or inhibitory, are comprised in one pattern of behavior, and the differentiation thus made possible accounts for the beginnings of the various instincts we have described.

Each separate instinct, though classified as individual, sexual, or social, has a close relation with every other instinct, and the opposite phases of attraction and avoidance are to be found in them all. *Rage* is predominantly aggressive, and the instinctive manifestations of hunger in *nursing* and *hunting*, though less energetic, are also modes of attraction. *Love* and the behavior of contentment may be almost passive. *Curiosity*, or "cautious approach," shows attraction and avoidance, inhibiting and succeeding one another. This mode of behavior is also responsible for certain specialized instincts, such as *acquisitiveness*, *constructiveness*, *adornment*, and *cleanliness* which, on the whole, are forms of attraction. *Fear*, however, is predominantly an avoidance-reaction, and so is *repulsion*.

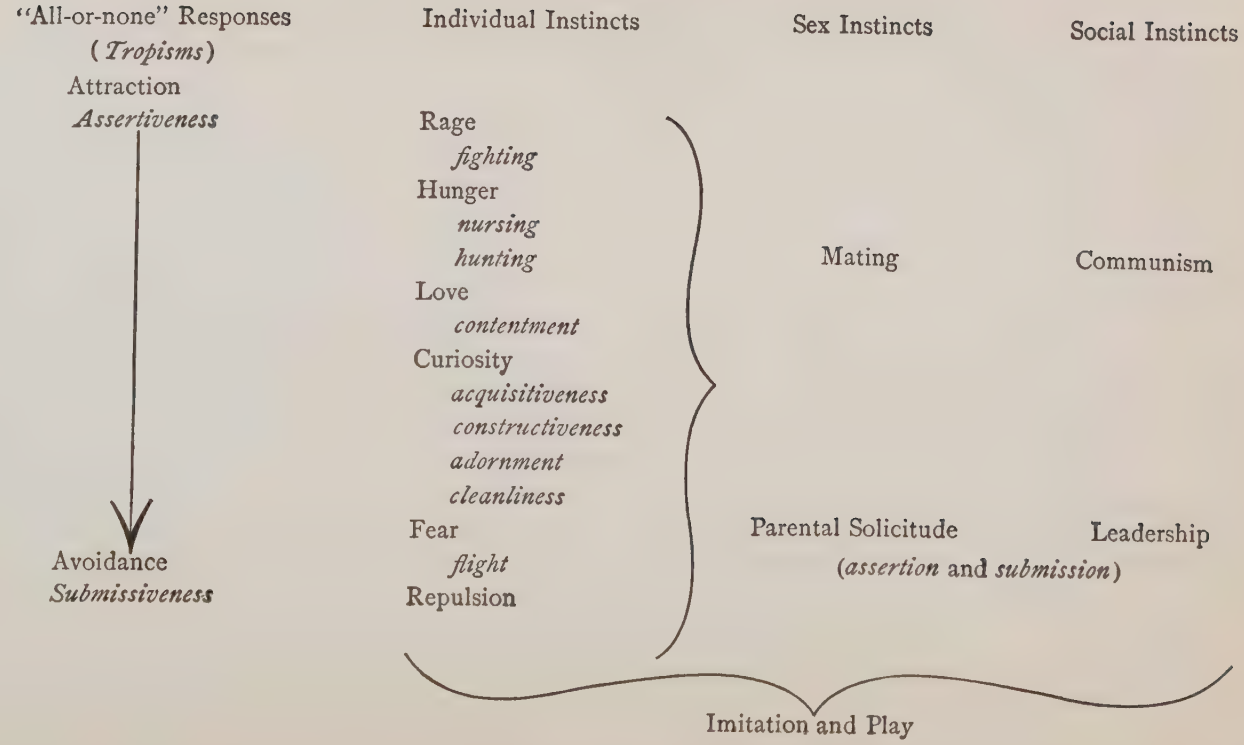
These instincts express themselves not only as individual desires but also in sexual and social situations. Love is the foundation of *mating* and likewise of *communism*. *Parental*

solicitude involves both assertion on the part of the parent and submission on the part of the child, and suggests an origin for *leadership*. All these special modes of behavior can be initiated by *imitation* as well as by an appropriate objective. This does not mean, however, that the precise behavior of fighting, hunting, courting, constructing, etc., will be carried out by the imitator; but only that a certain readiness for that kind of response can thus be initiated.

Finally, instincts express themselves both *seriously* and *playfully*. The attitude of play is natural to childhood, and provides a means of instinctive expression without serious intent. In other words, the same behavior which under one set of conditions will be pursued until a dominant want is satisfied, under another set of conditions will be followed tentatively and incompletely. While a playful response is attributable to surplus energy, and may possess a considerable value as a preparation for serious undertakings, it is promoted primarily by the enjoyment of doing something without compulsion.

These general comments upon instinct are diagrammatically summed up in the accompanying table (Table II); which, however, is but an imperfect picture, first, because no effort has been made to survey the field of instinctive behavior completely, and, secondly, because the classification is more empirical than scientific. Yet even so, the table may prove helpful in relating individual desires to less differentiated forms of attraction and avoidance on the one hand, and to group expressions of sex and society on the other.

TABLE II


"All-or-none" Responses
(*Tropisms*)
Attraction
Assertiveness
Avoidance
Submissiveness
Individual Instincts
Sex Instincts
Social Instincts
Rage
fighting
Hunger
nursing
hunting
Love
contentment
Curiosity
acquisitiveness
constructiveness
adornment
cleanliness
Fear
flight
Repulsion
Mating
Communism
Parental Solicitude
Leadership
(*assertion* and *submission*)
Imitation and Play

CHAPTER VIII

SITUATION AND EXPERIENCE

§ 31. *The Nature of the "Situation"*

In our previous discussion of original nature as it manifests itself in instinctive behavior, we have had frequent occasion to employ the terms *situation* and *experience*. It now becomes necessary to define these terms more fully; and this brings us to the psychological problem of *perception*.

We have found that organisms are not indifferent to their surroundings, but instead are always selective in their responses. As remarked on page 13, even the most undifferentiated total-response is quite other than a gross attack upon the whole environment. Though it be but a sort of lunge into the unknown, the occasion for such an act is always something more or less articulate amid the mass of stimuli which the environment is capable of affording. Thus organisms respond to light, heat, and pressure, but not to a chaotic mixture of all three stimuli acting at once. Just as the behavior of an organism is always somehow patterned—if only by virtue of the fact that an organism is a definite structure, the members of which coöperate as a whole—so the situation, which is the counterpart of behavior, is also patterned. The latter portion of this statement is perhaps less obvious than the former, because

whereas an organism implies an arrangement of protoplasm into an organized whole, the environmental situation can be conceived in terms of so many discrete stimuli. Indeed, the analytic enumerative procedure of formal logic has made great headway in describing external nature in terms of more or less elemental integers (cf. § 27). It is sometimes hard to convince a scientist that facts are not essentially quantitative units which, in principle at least, are capable of an exhaustive treatment by the simple enumerative procedure of a mathematical formulation. Yet recent discoveries, both in physics and in mathematics, indicate a modification of this view which seems destined to revolutionize our entire conception of matter and force. I need allude only to the current theory of non-Euclidian space, to the Einstein theory of relativity, and to the quantum-theory advanced by Planck, in order to make it plain that a definite space and a definite time, serving as universal forms within which the unit-data of science can all be nicely relegated, are no longer the reliable fixtures they once seemed to be. Instead of a static world, we seem to find ourselves confronted with an ever-changing, self-generating universe, only the genetic and the functional patterns of which permit the application of a physical law of identity.[1] Instead of a bombardment of unit-stimuli to which an organism must make its adjustment within a fixed space and a fixed time, the functional unity of behavior appears to be a counterpart of the equally functional unity of the

[1] Whitehead, A. N., *Science and the Modern World* (1925).

situation in which the organism finds itself. The "situation" is not something entirely disengaged from the organism and its behavior, but something which participates as a member of the organic pattern of response. As J. S. Haldane has put the matter, "regulation of the external environment is in fact only the outward expression of regulation of the internal environment. . . . An organism and its environment are one." [1] We have already seen that the "touch-and-go" response of a reflex is a derived and not a primitive mode of behavior; yet even here it is difficult to find a single instance of reflexive activity which is not in some measure self-regulatory—that is, immediately participating in the functional variations of patterned stimuli. In the more general responses which we have called instincts, this participation of the external situation in the response is everywhere apparent in what Lloyd Morgan calls the organism's "persistency with varied effort" in seeking an end.

A simple illustration of what is meant by this self-regulatory adjustment, as distinct from a "touch-and-go" type of invariable response, can be drawn from eye-movements of fixation. It is well known that from early infancy the eyes adjust themselves to a seen-object with reference to the central or foveal region of the retina. This region is more sensitive than the peripheral areas, and serves as a focus, or point of orientation, about which other points can be symmetrically placed. Eye-movements are thus made with reference to this small area of clearest vision,

[1] *Organism and Environment* (1917), pp. 93 and 99.

and when both eyes find this "center of gravity," as it were, the outlying portions of the object seen will be symmetrically placed about the center of each retina. An object so viewed that its center is reflected upon the fovea of each eye, will have its outlying portions reflected upon corresponding points about this center. Under these conditions we see but one object; whereas whenever the same point of the object is reflected upon non-corresponding points of the two retinæ, we see that point as double. This doubling of the image will not occur when the object is a flat surface, but will take place whenever any point on the object is at a greater or lesser distance from the eye than the point fixated on the fovea. It is obvious that if double vision were to persist and become effective, the behavior towards seen-objects would be confused and mistaken. But the eyes move readily and automatically, as their reflexive nature permits; consequently, as soon as a double-image becomes insistent, the eyes shift in the direction of the double-point, bringing the object upon the foveal regions where it becomes single. In surveying a three-dimensional object near at hand, the eyes make exploratory movements which constantly transform double- into single-images. Whenever this transformation occurs, we realize that it is but a single object that we see, and also that it is a solid object, some parts of which are nearer than others.

The regulation of eye-movement has usually been explained by a mechanism in which only the points stimulated, together with the movements thus initiated by a double-

image, are involved. Accordingly, a succession of discrete "touch-and-goes" has been thought to be sufficient to cover all these regulations of the eye in its process of orientation.

But certain important items have been omitted from this account; namely, the coöperation of the whole organism on the one hand, and of the entire field of view on the other. Take the simple instance of altering fixation from one point to another in the same plane, and compare it with the fixation of two other points likewise in the same plane, and equidistant from one another (see Fig. 2). Although the eye-movements made in passing from the fixation of A to the fixation of A_1 are the same as those made in passing from B to B_1, it is obvious that these two are not identical orientations. In the first instance, the center of gravity shifts from A to A_1; in the second, a new orientation provides the setting for the same eye-movement in its shift from B to B_1. And hence, a mere enumeration of particular responses invariably conditioned is insufficient to cover the grounds of even so simple a reflex as that of visual fixation. Instead, the reflex must find its place within the larger matrix of a total-response to a total situation.[1]

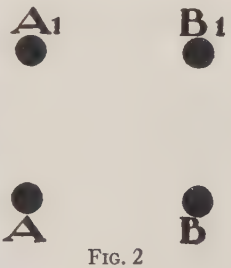


FIG. 2

But what is this "total situation"? Already we have denied that it is a chaos of more or less conflicting stimuli. In the case at hand it is to what we *see* that a response is made, and not to what we *feel* by contact, or hear, or taste,

[1] Cf. Koffka, *The Growth of the Mind*, p. 77.

or smell. Reverting to an earlier description of behavior (p. 27), the phenomenal situation is always a *figure* on a *ground*. The visual impressions of the dots in our illustration are the occasion for the orientation that results; they constitute, successively, the visual features that emerge in experience and control or regulate the behavior of fixation. As we fixate A, the other three dots in our illustrative figure are in the background. As fixation passes from A to A_1, A_1 emerges and A recedes into the background; likewise when we proceed from B to B_1. But the background is not the same in these two cases. Nor is this background, to which we refer, merely the field of vision—as though it were a fixed space with one set of invariable coördinates. On the contrary, the background is the entire psycho-physical setting of the experiment, including both the experience of the two different fields that confront us in the two different orientations, and the responsive adjustments of eyes in body, which are also involved.

§ 32. *The Nature of "Experience"*

In order to understand these conclusions, we must now consider what *experience* is, and why we must speak of a psycho-physical process, whereas in our previous discussion we have left *experience* more or less out of account.

The introduction of "experience" into an otherwise biological situation is a new departure; for although experience is always implied and frequently referred to in studies of the behavior of living organisms it is not as a rule

well understood by the biologist; and the physicist usually tries to ignore it altogether. Furthermore, it is sometimes maintained that, despite the "evidence of our senses" that we feel and see and hear, these phenomena, as such, are individual and intractable, and cannot therefore be introduced into a truly scientific consideration of *facts*. Accordingly, one meets with attempts to explain behavior *scientifically* in terms of situation and response, the former as a physical datum, the latter as a biological datum. Psychology then becomes the *objective science of behavior*.

Two replies can be made to this attempt to treat psychology without its *psyche*. The first is that to place physical stimulation in opposition with a biological response is to misstate the facts of behavior. As we have found many occasions to note in our discussion of instinct, and as we have just now shown in the simple experiment of visual fixation, the physico-biological organism is not two things—a physical situation and a biological response—but one thing, in which the formal pattern of the situation participates in the organic response.

The second reply is that a situation-response as a single organic whole is revealed only in terms of *felt enjoyment*. The original datum of whatever is formed or patterned can be stated only in terms of experience. It would therefore be highly unscientific if we were to lift ourselves entirely outside of experience when we systematize empirical facts; because we must still employ the formulæ which have been derived from experience. Indeed, we should find ourselves

in the false position of denying the scientific status both of our empirical facts and of our method of dealing with these facts. In other words, facts are discovered by experience, and the formulæ of logic and mathematics which are applied in their interpretation are likewise derived from experience; and hence to deny a scientific status to experience on the ground that it is always an individual phenomenon is to deny the validity of objective facts which must first be observed before they can be formulated into a scientific system.

Philosophers have often played with the idea they call *solipsism*—that is, a radical reduction of all "facts" and all "reality" to the phenomena of the experiencing individual. The futility of this reduction is clear, because the counsel of such a philosophy is one of despair. No "subjective idealism," finding its "facts" in the experience of a single individual, has ever been able to give a warrantable status to any facts save the bare assertions of the moment. Despite this denial of reality outside the individual experience of the moment, science has proceeded with its discoveries, weighing and measuring conditions and results, until the facts observed have been given their proper place in an experimentally determined world-order. The physicist is undismayed in his disregard of experience and the qualities of individual observation as he proceeds to measure all in terms of quantity. Furthermore, his procedure is amply warranted by his peculiar attack upon the universe as matter and force. The biologist, too, confines his interest

to growth and development in the behavior of living organisms with regard to their morphology and physiology. His outlook and his task are likewise determined by his special problem. And yet the same universe of matter, force, and life is also subject to a third kind of inquiry, which the psychologist undertakes. Here the experience in which the facts of physics and biology are discovered, and the very formulæ which each and all must employ in organizing these facts, are the special subjects of study. To deny this task because it seems difficult, or because at first view it seems to lack the universality demanded by scientific concepts and procedures, is only to avoid the issue. But the issue cannot be avoided. Although physicist, biologist, and psychologist each looks upon the world from a different angle, or, as one might say, through different lenses, it is the same world that is viewed and studied by all. Therefore, the task of a true philosophy is to reconcile these differences, and piece together and reconstruct the whole world, which scientific research, of whatever kind it may be, has discovered and formulated.

The reason why this whole-world does not reduce to the individual experience of the solipsist is given in the dependence of individual experience upon conditions which are not supplied by the individual. However "subjective" experience may be—and even subjectivism is more a logical than a psychological postulate—the conditions under which an individual observes what is going on are only in part those of his own mind. Were they altogether such, we

should have no sciences like physics and chemistry, botany and zoölogy. Whatever the nature of the empirical data to which a scientific method is applied—be it the stars, or the earth, living beings and their customs, or the historic remains of past action and conduct—the validity of the method is always subject to a critical review with respect to the generic origins of the method; and it is this review that gives us the cue to the fundamental identity of all being and all thinking.

§ 33. *The Principle of Genetic Identity* [1]

The importance of a genetic approach to education is very great, because the human propensity to specialize and thus to departmentalize learning produces not only lopsided individuals, but entirely false conceptions of life and conduct. The real significance of all facts, to revert again to the so-called psychological method of instruction as contrasted with the logical method (cf. p. 21), rests upon their genetic identity with other facts. The individualism of a subjective point of view is no better, and no worse, than the individualism of an objective point of view which regards one set of facts as though these facts had no bearing upon anything outside their own peculiar domain. What is a study of language apart from the life, the customs, the history of the people who employ it? Even the bare bones of grammar, rhetoric, and syntax have an existence only

[1] Our interpretation of genetic identity is not the same as that proposed by Kurt Lewin in his use of the term *Genidentität*. Cf., however, *Der Begriff der Genese in Physik, Biologie, and Entwicklungsgeschichte* (Berlin, 1922).

when clothed with the flesh of living speech. To study the skeleton is to familiarize oneself with the parts of speech and their articulation; but who would take interest in a skeleton unless he were concerned to know something of the living body in which it functioned? The danger of *logicism*, as we may call it, is that we should confine ourselves entirely to the skeleton, forgetting that its genetic origin was determined, not as a mere development of bony structure, but as a member of a complete organism with muscles, tissues, glands, etc.

From this same genetic point of view, we see that what in adult manhood is a being with mind and body set in a varying environment of external forces, was in the beginning a creature but slightly differentiated from its surroundings, while within itself it possessed even less differentiation among its own members. Mind, body, and environment are results of a gradual evolution. But even granted an observer equipped with adult human intelligence to make the differentiations, physical, biological, and psychological, which the creature itself is unable to make, is not this observer's method of description and explanation likewise a product of the same lowly and undifferentiated behavior which the protozoön evinces? And if so, must not this observer be in some ways genetically identical with his lowly original? How can such a diversity arise, that distinguishes mind from body, and both from the surroundings in which the psycho-physical organism finds itself? How, else, one may answer, save by a natural process of

evolution in which, despite all diversity, something of likeness remains in all three?

Here again we meet the paradox of continuity and change, which makes it impossible for us to speak of one process without the other. In one sense, all the potentialities of life and being are implicit in everything that exists; even the ions with their electrical charges show individuality and a certain independence of behavior. But in another, and a more important, sense, the form of action or behavior is constantly changing into something new, different, never before attained. This is a principle of evolution which may be truly described as a *transformation.*

We have discussed this fact briefly in a previous chapter (cf. § 22), where we pointed out that all change is saltatory—a sudden transformation into something new and different. We referred this paradox to a biological or genetic logic which must be prior to the formal logic in which so gross a contradiction appears to be impossible. But if in the beginning the crude dichotomous opposition of an ill-defined whole merely sets that whole off from a still less differentiated ground, it matters little if the edges of the pattern are nebulous and uncertain, provided that the internal structure holds somehow together in contrast with its surroundings. In the beginning there is no clear-cut dichotomy such as the formal logician defines, but only a pre-logical definition of *something* emerging from a ground which, for all practical purposes, is *nothing.* Every step in the definition of this positive *thing* depends upon proc-

esses of articulation. As articulation takes place, the genetic identity of a thing with its original is at every stage preserved. But at the same time, paradoxical as it may seem, particulars emerge suddenly as new forms within the whole, and at once constitute unique facts in a now more definite setting.

Thus both evolution and education proceed by defining an at first amorphous subject into an integrated and individuated whole. In this process, what is true of the environment is true also of the body of the organism; and what is true of the organism is true likewise of its mind. The genetic identity of the original pattern of a semi-amorphous whole remains throughout all change in evolution of world-systems, of organisms, and of minds. But, although the principle of genetic identity enables us to trace the origin of every form in some more general and more amorphous antecedent, the precision which definition gives to any particular is a resultant of sudden and unique change. What was previously a mere dependent member or aspect of some larger whole, now, under appropriate conditions, emerges as an individual within the set conditions of the whole; a member suddenly articulates itself into a new and original pattern, distinct from the matrix from which it has emerged. Accordingly, we have the paradox of a genetic continuity constantly throwing off individual patterns of matter, of behavior, and of experience.

Despite the wide difference between the avenues of approach from which a physicist, a biologist, and a psycholo-

gist reaches these particulars, the fundamental forms which they assume are nevertheless identical, because they are but the forms of one universal logic. Thus, experience is something apart from body only as its content is specifically defined from the psychologist's avenue of approach. Formally, it is one with body; and the same forms which enable us to deal with things in classes pursues and parallels the observer's mental operation of classification. The most diverse contents are subject to the same process of definition, so that an identity of form remains despite all difference of content. In stating the parallelism of mind and body we are, in reality, stating their identity of form. Rightly considered, form is always the same whether it be construed by a physicist, a biologist, or a psychologist. The coherence, or articulateness, of a physical unit affects the psycho-physical organism by virtue of its integrated pattern. The organism in turn is receptive to this pattern because it is possessed of a counterpart in function; and, finally, the purely psychological aspect of behavior is likewise identical in its form with the physical and biological forms, which are in turn its counterparts. What man is able to departmentalize and distinguish as three worlds—objective nature, individual organism, and mind—finds its genetic origin and the key to its interpretation in the evolution of identical forms, and their differentiation.

This long argument is intended to justify us in attaching a scientific importance to experience, so that in proceeding, as we now shall, to the study of perception, we may feel

free to examine the facts of experience, not as mere phenomena of an individual mind cut off from every other being, and hence intractable, but as forms that are capable of affording us insight into the true nature of behavior, and likewise into the nature of the environment which provokes behavior.

CHAPTER IX

PERCEPTION

§ 34. *Perception as a Pattern of Behavior*

The study of psychology begins with perception; and so too does the study of education. Although the adjustment of individuals to one another and to their common environment is the end of education, perception is the beginning and the continuous process of achieving that end. A perception, therefore, is any experienced circuit of events. In time it has a beginning and an end, although in the mesh of continuous happening, in which different strands are constantly overlapping, it is often difficult, if not impossible, to determine either an absolute beginning or a finite end; which leads us to wonder if time, in its ever on-flowing course, is really the safest guide in the analysis of experience. If it is not, then the conception of a circuit in which a want is satisfied is perhaps a truer description of adjustment. In turning full circle the end coincides with the beginning; in satisfying a want a gap is filled, and the want disappears. But this, too, is a crude attempt to describe in alien terms a fact of experience which cannot be thus simplified without a certain falsification.

When I glance at a stone lying in the road, I am said to perceive it if I give heed to it—that is to say, if I do something

to it, (1) look at it, (2) seize hold of it, (3) stumble over it, or (4) step around it. Yet some, or all, of these things I can do to the stone without truly perceiving its presence. While engaged in thinking, I may look at the stone without in the least disturbing my train of thought; I may idly seize it and throw it into the near-by field. If I stumble over it, obviously I can scarcely have heeded it in due season; and even if I carefully avoid it in my passage, I may do so quite unconsciously. Yet, with the exception of the third act—stumbling over the stone—each of these heedless adjustments may depend upon a previous adjustment, in which I did perceive the stone as something to be dealt with; and even the exception verifies the rule, because stumbling over the stone is typical of the very first adjustment which a new situation forces upon me. In the first place, perception means being forced to give heed to something, and to do with it what one can. In case I tumble sprawling over the obstacle, my perception of the situation is confused, and my behavior, no doubt, ungraceful; yet it is from just such uncoördinated efforts that I learn to stabilize myself and to avoid obstacles.

The completeness or incompleteness of adjustment, its fullness or its paucity of detail, its refinements or its crudities, and all the other characteristics of manners good and bad, of habits, tastes, and skills, are intrinsic features of the pattern of behavior. The pattern, as experienced, also accounts for what we term *insight*. When I stumble over a stone in my path, I lack insight regarding the stone; but

if I look at it, seize it, or walk round it, I possess insight, either at the elementary level of doing these things heedfully, or at the more advanced level of doing them by habit as a result of previous heedful behavior.

It has been customary for psychologists to define perception as something that belongs peculiarly to mind. With this mode of analysis one would seek to reduce the perception of a stone in the road to the sensations of vision, contact, and movement, together with the associated images, involved in each of the four adjustments previously described. But it is obvious that the educator has a greater interest in the adjustments themselves than in any catalogue of sensations, be they of sight, touch, or movement. What he wishes to know concerns the training that will lessen the child's tendency to stumble over an obstacle—that will lead the child to focus clearly and observe carefully what he sees, that will enable him to grasp and handle objects, to throw them with skill, and to modify his course of locomotion with specific reference to their characteristics as obstacles—none of which is revealed by a minute analysis of the sensory constituents of the experience itself. Valuable as such an analysis may be, not only as an exercise in "pure" psychology but also as an indispensable adjunct to our knowledge of mind, it is doubtful if analysis is ever appropriate until we have first discovered what patterns of experience are practically significant in the way in which the educator, among others, views them.

Therefore, instead of defining perception as a complex

of sensory experience and associated imagery, we have defined it more broadly as the experience of a *closed circuit* of events. Indeed, it is because of this "closure" that we give heed to a series of events, and thus *perceive* it. The dynamic nature of the circuit is indicated by a real or quasi beginning, and a real or quasi end. The notion of the circuit is appropriate, because the end completes the process. It is not as though a final term were merely added, giving finality simply because there are no more terms. However chaotic and unsatisfactory it may be to stumble over a stone, my behavior—including my experience of the accident—is a self-contained whole, the *configuration* [1] of which is a function of my entire bodily and mental equipment, plus the stone that sent me careening. When I find myself prone and relaxed upon the ground, I may be disinclined to regard my experience as one in which a desire has been fulfilled; but the reason for this is that I have other and more interesting desires than to be tumbling about on the roadside. I may even be humiliated to think that I should have been so clumsy or so stupid. But to a child—barring the pain that usually attends such an event—tumbling about may be a blissful experience. Despite the painful after-effects of bruised shins and scraped

[1] *Configuration*, a term we shall use extensively in the following pages, is a translation of the German *Gestalt*, signifying any mental or physical structure the unitariness of which defies analysis. Configurations are transposable, like melodies, and when they appear and disappear they do so "altogether." What we have previously called the "pattern of behavior" is a configuration; but we shall employ the new term more broadly, especially in describing the unique coherence of certain mental phenomena.

knees, the excitement of the unexpected encounter, and the relief that follows when it is over and the body has relaxed, form a simple circuit of tension and relief that characterizes the experience as a true perception.

We cannot dismiss this experience, however, without a reference to the component of fear which is involved. According to Watson (cf. p. 36), the sudden and unexpected removal of support is one of the primary conditions of the emotion of fear; and fear is not usually regarded as a satisfying experience. A perception, however, is always a satisfying experience; and it attains satisfaction through completing a circuit of events, by finding an end appropriate to the beginning. Fear is experienced in a sudden encounter with an obstacle which disturbs a previous state of equilibrium. The preceding stability of a state of quiescence, such as sleep, or of any straightforward endeavor, like walking, manipulating objects, or merely "thinking," is destroyed by this encounter, and the instinctive response that ensues is largely determined by general and innate, rather than by acquired and specific modes of behavior. But as we have already noted, it is instinctive to strive for a change that will relieve a distressing situation. When one lands on the ground the fear that attends falling is over, and although other pains may ensue, the pain of terror is gone. Indeed, the fear of falling greatly interests the child, and seems often to suggest a happy rather than an unhappy outcome. Consider the prevalence of infantile dreams of falling which terminate, not with a bump, nor

always with a terrified awakening, but often with the sensation of being wafted delightfully away into space. The fascination of a dive from a height into a soft receptacle, like water, or a hay pile, also show us that in childhood fear is not necessarily shunned, but in certain forms is even cultivated. Thus, the dissatisfaction of fear may be only a component of a perception which, taken as a whole, is satisfying when its circuit is completed.

To repeat, a perception in its original form is like a sudden stumble over a stone in one's path. And while in this particular case fear is more or less inevitable, and of itself an unsatisfying experience, the termination of the fall allays all fear, and—barring the painful bruises that may ensue—a safe landing stabilizes the previously unstable situation by closing the circuit of the act with an appropriate end. The important feature of the experience, and the one that gives it the character of a perception, is the closing of the circuit.

So far as the individual himself is concerned, perception is limited to the events one can continuously give heed to. Although the life-cycle of an insect, or even the whole course of a human career from birth to death, has each some of the characteristics of a single perception, no one can be aware of all that is compassed in a lifetime. Instead, one must be content to survey merely those members of the series that can be compassed. Therefore, it is these members, as they emerge and disappear, that constitute the specific events of life; and while they all participate in

the onward course of the life-cycle, it would require a superior intelligence to envisage them as a whole. Speculatively, a philosopher can do this; practically, instinctive nature provides impulses which cause us to return to a task once interrupted, and to begin anew something already started but only partially completed.

§ 35. *The Æsthetic Nature of Perception*

Whereas perception is a circuit, the closure of which is heeded, the life-cycle, embracing all perceptions, is incomprehensible save by an artificial effort of abstract thinking. Professor A. N. Whitehead calls the interweaving of perceptions into the larger course of life *the rhythm of education*. He writes:

> Life is essentially periodic. It comprises daily periods, with their alternations of work and play, of activity and of sleep, and seasonal periods, which dictate our terms and our holidays; and also it is composed of well-marked yearly periods. These are the gross obvious periods which no one can overlook. There are also subtler periods of mental growth, with their cyclic recurrences, yet always different as we pass from cycle to cycle, though the subordinate stages are reproduced in each cycle. That is why I have chosen the term "rhythmic," as meaning essentially the conveyance of difference within a framework of repetition. Lack of attention to the rhythm and character of mental growth is a main source of wooden futility in education.[1]

Again he says:

> Education should consist in a continual repetition of such cycles. Each lesson in its minor way should form an eddy cycle

[1] An address entitled *The Rhythm of Education* (London, Christophers: 1922), p. 9.

issuing in its own subordinate process. Longer periods should issue in definite attainments, which then form the starting-grounds for fresh cycles. We should banish the idea of a mythical, far-off end of education. The pupils must be continually enjoying some fruition and starting afresh—if the teacher is stimulating in exact proportion to his success in satisfying the rhythmic cravings of his pupils. . . . Our modern system, with its insistence on a preliminary general education, and with its easy toleration of the analysis of knowledge into distinct subjects, is an equally unrhythmic collection of distracting scraps. I am pleading that we shall endeavor to weave in the learner's mind a harmony of patterns, by co-ordinating the various elements of instruction into subordinate cycles each of intrinsic worth for the immediate apprehension of the pupil. We must garner our crops each in its due season.[1]

In other words, we must start with perception. Under the guidance of dispositions, both inherited and acquired, the cycles of our behavior will then take shape; and apprehension, at first limited to a subordinate cycle, or subject, will become extended with the aid of abstract thinking until we are able to compass the larger course of events that require hours, days, and even years in their fulfillment.

But long before we are able to think about life in general, and about its larger problems, we are guided in the pursuit of ends that are not comprised within the cycle of a single perception. And this guidance is afforded, not by discernment, but by *feeling*. In the discernment of a perceived event our disposition is a positive factor no less real than the event itself. The feelings which attach to a dis-

[1] *Op. cit.*, pp. 13 and 16.

positional readiness for response—either in a single perception, or in a series of perceptions, interrupted, perchance, by pauses of sleep and distraction—are *æsthetic*. It is the æsthetic feelings that mark the rhythm of life, and hold us to our course by a kind of weight and balance.

The conformity of any specific event to the impulses and demands of life as a whole is felt even when it cannot be discerned. Experiences of whatever sort stamp their patterns upon us with a constant reference to the dispositions we inherit and acquire. The conformable patterns are in the first instance those that fit into the total economy of living; furthermore, the *fitness* is quite as much a fitness of environment to organic needs as it is a fitness of the organism, with its manifold powers and potentialities, to the environment in which it happens to be cast. Whenever a fit pattern of behavior is undertaken, one feels at once the ease with which it is apprehended, and the appropriateness of the action that ensues. Such a pattern will serve as a prototype for subsequent action and comprehension; and once it is discovered, other and less conformable modes of behavior will assimilate themselves to it. This is a fact of vast importance for education; yet it is a fact too often neglected in the methodology of teaching.

If we consider perception as an experience which is set off in a kind of dichotomous opposition to the background upon which it appears, the conditions that determine the articulateness of the percept will not merely be those of its own internal structure—as a self-contained,

detachable object, like an apple or a stone—but will also be those of the surroundings that permit of this detachment. A detachable object that can be seized, or moved, or otherwise separated from its ground, is more readily perceived than something which maintains its membership with something else. But the conditions of perception are not exhausted by these objective conditions. The appearance of a thing does not always tell us whether or not it is separable from its ground; and some things emerge and are perceived even though they are not objectively detachable from their surroundings. Hence a specific disposition to perceive is often added as a further condition of perception.

A disposition to feel the completeness of an experienced event as being right and fit constitutes what we have called the æsthetic factor in perception. We not only give heed to whatever occurs to us as somehow emphatic and insistent—like a flash of light, or a loud sound, or a blow on the body—we also give heed to, and find a peculiar satisfaction in, those appearances or events for which we are predisposed. *Readiness* to perceive this, that, or something else, is a selective agency, the roots of which lie deep in the instinctive nature of man. The contribution of the background of experience, including man's original impulsive nature, is in no wise a negligible factor in perceptual behavior; on the contrary, we are always ready for some things, and unready for others; and this state of readiness or unreadiness is not merely an effect of habit—as though fre-

quent repetition could make one equally ready to endure anything—but is also an original propensity for certain forms of behavior and for certain shapes of experience. The figures thus selected constitute the basic structure of both apprehension and response. When a figure fails to appear, all is chaos, uncertainty, and aimless wandering. No doubt an intimate connection exists between a preferred form of experience and the corresponding form of the object that occasions it; but this connection cannot be ascribed to the physical or chemical *ingredients* of the object, nor can it be understood by an analysis of the "elements" of sensation which the experience contains. Instead, the common denominator of an object and its apprehension, or of a situation and the response thereto, is the common form of both. Furthermore, since form is defined by context, what the mind brings to apprehension, and what the organism brings to its response by way of dispositional readiness, have their respective counterparts in the background of the object apprehended, and in the total situation to which the response is made.

The points we are stressing are two. 1. Since the processes involved are essentially the same, a perceived object is a member of a perceived response. In one, the "thing"-aspect is stressed, in the other, the behavior-aspect; but no "thing" can be perceived without a process of adjustment, and no behavior takes place without an objective. Whenever an objective stands out in the process of adjustment, in relative independence of the perceiver, we speak

of perceiving a thing. Thus, we can look at a thing or grasp it, smell it or taste it. On the other hand, when the objective is not clearly detachable from the response, but instead is intimately bound up with the adjustment, we perceive the behavior rather than its objective. This latter process of perception is more primitive than the former, and is illustrated by an ill-advised tumble over a stone, rather than by a well-advised detour around the obstacle. At first, then, objectives and things are the more or less outstanding features of a process of behavior; later on, in the course of education and development, they emerge as semi-independent objects with which the behavior of response is concerned. This emergence depends upon conditions suitable to a definition of certain members of the act of behavior as its starting-point and its terminal. Thus, the stone must first be seen or touched in a certain way before we can proceed to grasp it and throw it, or make a detour around it.

2. This brings us to the second point. The difference between a confused process of adjustment, such as tumbling over a stone and the more definite behavior of seizing or avoiding the same stone, is attributable to the manner in which the situation is confronted. In the first instance, there is no dispositional readiness appropriate to a definition of the objective—the stone—as a thing to be taken or left, acted upon or reacted against. The response is a crude undifferentiated fall, with no clear apprehension of its parts. In the more highly educated responses of looking at the ob-

jective, seizing it and throwing it, or tracing one's steps carefully around it, the organization of the entire experience has been effected by a dispositional readiness which coöperates with the objective conditions of the thing perceived.

Contrary to the common assumption that the æsthetic aspects of experience are a product of the highest intellectual attainments, the very first effort to define an object shows the æsthetic aspect of experience in a simple and striking manner. At a primitive level of behavior the æsthetic can be defined as a differential sensitivity; *differential* because some perceptions are accepted while others are rejected; *sensitivity* because the process, though felt, is entirely unreflective. The immediate fitness of the object perceived, or the behavior undertaken, is the criterion of the æsthetic at every level of intelligence; but at a primitive level, differential sensitivity is as yet untouched by learning, and depends solely upon an inherent disposition of readiness for certain forms of environmental contact. Whereas at higher levels the structure of the perceived figure furnishes the chief data for an analysis of beauty, in the beginning, where nothing is as yet clearly defined, the background of the experience, including both the surroundings of the object and the entire psychophysical setting in which the specific behavior of response emerges, is also an interesting and important determinant of fitness. We are dealing here with a selective agency the effects of which are felt, not comprehended, and the conditions of which are compulsory, not chosen.

Since these originally æsthetic forms are the prototypes of both beauty and understanding, their significance for education is clear. What we mean to say is that some things are immediately perceived as fitting the situation in which they occur; and, likewise, that some acts are immediately perceived as suitable to the behavior in which they take place. In stumbling over an obstacle, no objective is perceived which possesses this quality of fitness; no unified whole emerges that can be felt as a perceived objective. An experience of this kind is not, and cannot be, æsthetic. The tumbling itself, however, has æsthetic possibilities as a process with a beginning which is fearfully exciting, and an end which closes the circuit with a state of relaxation and relief. Whether these æsthetic possibilities are realized or not, depends on the manner in which the body behaves. To fall gracefully is æsthetic; to fall awkwardly is not. It may be remarked that a fall is usually of the latter quality, formless and ungainly, and that a graceful tumble, like a "stage-fall," is always a product of learning. But the question remains: How can one learn to fall gracefully? The answer to this question gives us the key to the learning of any skillful act. Grace and skill go hand in hand; their achievement is never the result of combining acts which themselves are awkward and unskillful. In order to do anything gracefully and skillfully, one must first hit upon the "fortunate variation" in behavior which is most suitable to the conditions. Every tumble one takes presents a set of conditions to which the response is more or less suited.

Under unexpected conditions the behavior of tumbling that ensues is more or less haphazard. Yet the behavior of falling is never altogether unpredictable. The fall of an organism is never quite like that of an inert body, however closely it may approximate it. Consider how a cat will turn in the air and light on its feet. The responses which the cat's body initiates in the course of falling are selected with reference to the conditions of dis-equilibrium in which the cat finds itself. These conditions are met more or less adequately, more or less fittingly; and they are felt as such by the cat. In man, a certain relaxation of the muscles, conformable to the sudden propulsion of the body through space, will often lead to a harmless landing, whereas a rigid contraction of the muscles will produce an indecorous tumble.

In order to acquire a "stage-fall" one must resort to practice; but practice will never bring perfection in the art unless one hits upon an appropriate method, and selects it by the way it *feels*. The principle of learning how to fall gracefully, and indeed of learning how to do anything with skill, is not practice alone, but the creation of a response which is felt to be appropriate to the conditions imposed. Practice merely affords opportunity for making such a selection. We do not become graceful by simply repeating an awkward act until we become inured to it; for grace means economy of action, the right coördinations of flexion and contraction. Grace also means a selection of the conditions under which the act takes place. But so

far as any preconceived plan of action is concerned, this internal economy of response is, in the first instance, fortuitous.

We have called the acquisition of skill æsthetic, because the right response must be felt as such. Skill can never be acquired in any other manner. We must *feel our way through* a skillful act; for the members are always tied so intimately together that a conscious analysis of what we are doing can have no other result that that of disrupting the membered unity of the whole. To cite a crude example: it is impossible to walk in a straight line if one gives heed to the precise placing of each foot; whereas if one gives heed only to the goal, he at once unifies his behavior and is able to walk straight ahead.

Whenever an organism is suddenly confronted with a situation provoking an unpremeditated response, the behavior that ensues is more or less suited to the conditions under which the response is made. Under favorable conditions the response is more adequate, more fit, more graceful, than under less favorable conditions; the point being that adequacy, fitness, grace, are not arbitrary contingencies, but are characteristics of behavior which, when they occur, are seized upon because they *feel right.* This criterion of "feeling right," which operates, even at the lowest level of a confused and unexpected act of behavior, in selecting the better and rejecting the poorer method of response, is essentially æsthetic. In the pre-school age, especially, the child learns economy of movement by selecting what feels right and rejecting what feels wrong. In making these

selections he must, in large measure, work out for himself the rhythms of behavior which give him most satisfaction in their performance.

Yet this does not signify that educational aids are useless in the acquisition of grace and skill. It does mean, however, that the analysis of a skillful act is of no value to education unless the analysis reveals the rhythm of the performance. Furthermore, in order to make use of such knowledge, the educator must shape the conditions under which learning takes place so that the discovery of a right rhythm for every significant act of adjustment can be made as speedily and as economically as possible.

§ 36. *The Acquisition of Skill*

Our attempts to provide a satisfactory method of education in the acquisition of skill have largely failed, because our principles have been mistaken. In many text-books of education one can find the statement that a skillful performance is built up from a series of more or less discrete partial responses. By a process, sometimes called integration, which however reduces itself to the law of habit-formation through frequency of associative connection, acts, at first loosely connected one with another, become fused together. This fusion is supposed to result from practice, which facilitates the connection of the acts by wearing down the rough edges of their joints. The principle we are maintaining, which has already served us in our elucidation of instinctive behavior, reverses this assumption.

Instead of supposing that the organism is equipped at start with a number of reflexes that become integrated, or associated, by a kind of linkage into instincts and habits, we have found ample reason to believe that a total-response of the entire organism precedes any differentiation of partial activities, either in the phylogenetic series that accounts for the evolution of reflexes, or in the ontogenetic course of forming habits. Consequently, the acquisition of an act of skill is not a recombination of distinct and separate acts already in the possession of the organism, but the creation of a new form of response which appears suddenly with no other likeness to its antecedents than the genetic identity of this form with the matrix of behavior from which it arises.

The general course of this development in man is indicated by a control, first, of the whole body, then of the shoulder, the arm, the forearm, and, finally, the hand. Each of these members serves successively as the matrix of a more refined muscular control, the specific act of skill arising suddenly within its appropriate matrix when the body has matured and the conditions are ripe for its appearance. Thus, every act of skill is the focussing of behavior upon a new rhythm of response. Only with reference to the place which the specific act occupies in the total economy of behavior can we understand the appearance of such a rhythm. Consider, for instance, the nicely balanced manipulations of a skilled hand-worker. What in infancy was a crude total-response, focussing upon the

rigid contraction of the finger-muscles, has now become a finely differentiated, variable response in which each finger plays its appropriate part with reference to the matrix from which the response has emerged. Similarly, the co-ordination of the smaller muscles employed in handwriting emerges from a gross response in which pen or pencil was at first grasped and propelled over the paper by main force of shoulder and arm as well as by fingers and wrist.

In every case of acquiring skill, the right pattern of response must be sought within the matrix of a crude generalized type of behavior, in which the entire organism participates. Yet a "focus," as we have called it, is always sought and felt; *sought* because the behavior realizes its end by closing the circuit of an otherwise chaotic effort; and *felt* because at this level feeling is the only criterion of attainment. Whether a beginning is made with a definitized and localized reflexive action, such as the cramp-like closing of the fingers on a stick, or with the vaguer and more general response of propelling a pencil over a paper, in either case the course of development is supervised by the dispositional matrix within which the response finds its place. It follows that all change in the direction of learning is attributable to a dispositional readiness, either inherited or acquired, quite as much as to the precise nature of the objective or of the focal aspects of the behavior. In order to acquire skill in a performance, even one at first so crude and rigid as that of the clinging reflex, or so vague and uncertain as that of the first effort in drawing,

an æsthetic moment is requisite. The response most adequate to meet the situation at hand may occur by chance; but when it does occur it is selected because it alone among all possible responses fills the gap in what otherwise remains a felt want. While this right action can be referred to nervous, muscular, and even to physical laws of economy, these laws are themselves but the formulations of patterns of energy, an insight into which is gained only in so far as we can first feel and later apprehend their formal excellence. Consequently, the criterion of this excellence is at root psychological; and the inferences we are obliged to draw concerning the physical and biological facts that participate in any psychological function force us to conclude that the pattern of behavior revealed in the selection of an act because of its æsthetic fitness is the same pattern that determines its physical and biological counterparts.

Prior to any definition of an objective, be it a psychologically perceived thing, or a physically determined molar entity, events in behavior are marked off as circuits, the closure of which is more or less adequate to the conditions that obtain. Adequacy and inadequacy are "felt" because economy of behavior is so registered. An æsthetic motive leads every creature to adapt itself as best it can to the environmental influences that disturb its state of equilibrium. In order to find the right rhythm for any specific adjustment, a procedure of trial and error is at first indicated; not, however, in the sense of a perfectly aimless and chaotic response, but only in the sense of discovering within the

matrix of a behavior, at first crudely and imcompletely defined, a pattern that can be felt as adequate. When the right response is hit upon, the entire act is transformed. The internal structure of the behavior, until that moment vague and uncertain, now fits itself together as a complete and economical pattern—in a word the movement achieves a *melody* which it previously lacked.[1]

But an achievement of learning is not necessarily permanent because the melody has once been struck. While the criterion of feeling the right rhythm in a course of action manifests itself in a disposition to repeat this rhythm under similar conditions, the difficulty of controlling these conditions may be so great that neither the organism, left to its own devices, nor the opportune aid of a teacher is sufficient to guarantee the acquisition of skill in one successful effort. Consequently, trial and error are apt to continue in a series of incomplete performances, studded with an occasional success in retrieving the right melody. But gradually a certain degree of perfection is achieved in the course of repetitions, though the degree greatly varies from individual to individual, and from act to act. The point we make is simply this: the adequacy of any response, in which the dominant feature is not the discernment of an objective but a course of action, is determined by the æsthetic feeling which marks it. Furthermore, this feeling does not attach to any arbitrary action resulting from frequent repetition, but only to such rhythms of response

[1] Cf. Koffka, *op. cit.*, pp. 259 f.

as constitute what we have metaphorically called a "melody." A melody is not an arbitrary sequence of tones to which one has grown accustomed through frequent repetition, but a structural pattern, every tone of which is related to every other tone by means of qualities which satisfy an inherent dispositional readiness for harmony. There are many melodies, some simple, others complex; and the simple ones are often capable of enrichment through elaborate variation. So it is with skilled movements. The right rhythm of a specific adjustment may be simple or complex; and simple patterns can be elaborated and enriched in the achievement of fuller and more desirable ends. But in no case is this development arbitrary. Whatever the range of possible variation, and however limitless the range of improvement in any so-called act of skill, the pattern within which perfection is sought always defines itself in terms of the situation, and the response which this situation demands. No one can say how skillful a typist or how expert a golf-player may become; but the patterns of response in which skill is attained in these two forms of behavior are in no wise arbitrary, nor can they be defined by the individual as objectives. Although the goal of an expert typist may be to increase the number of words written per minute, and the goal of a golf-player to achieve a count less than bogey, the improvement of skill whereby either goal is attained can only be felt as a continuously appropriate rhythmical pattern. The improvement is therefore æsthetic; for it must be made in terms of balance and proportion, rather

than in terms of a clearly defined objective. Furthermore, the background of the experience, including the disposition of the entire organism, is involved; for only in an æsthetic attitude do we feel balance and symmetry, proportion and rhythm.

Since the acquisition of skill in adjustment is more primitive than the discernment of objects—since, indeed, the discernment of objects is a process of abstraction from the more original type of felt-responses—it is obviously of the greatest pedagogical importance that this principle of æsthetic education should be understood and applied in all the initial stages of learning.

Primitive peoples understand the use of this principle better than we, although the principle is by no means one that is employed only at a primitive level of culture. The highly intelligent Greeks of the classic period conceived and practiced an æsthetic method of education which can properly be termed *eurhythmic*, that is, an attempt to seek first of all the right rhythms of behavior. Both Plato [1] and Aristotle [2] discuss at length this method and its implications; and a modern attempt to recover something of this lost art of Greek education has been made by a Swiss musician, Émile Jaques-Dalcroze.[3] Although Dalcroze has limited his methods to dancing and music, the principle is one that applies equally to all learning, and especially to the instruction of children before they have become spoiled by the wooden conventions of habit and routine.[4]

[1] Cf., especially, *Republic, 3* and *Laws, 2* and *7*.

[2] Cf., especially, *Politics, 8*. 3 and the *Poetics*.

[3] Cf. *Rhythm, Music, and Education* (1921).

[4] Cf. the writer's essay entitled "Eurhythmic," in *The Sewanee Review*, October, 1920.

CHAPTER X

AFFECTION

§ 37. *Perception and Affection*

In our previous discussion of perception we have emphasized the response of the organism. An overt response is perceptual whenever it gives phenomenal evidence of articulateness. The criterion of articulateness is to be found in the nature of the figure that emerges from the more or less unformed background of experience. From the point of view of an analytic psychology, perception is at core a sensory phenomenon to which the phenomena of affection and imagery are added. As an act of behavior, however, a perception is an explicit response. The implicit responses of smooth muscle and of gland, to which Watson, for instance, has attributed the emotional coloring of instinctive behavior (cf. p. 35), are not perceived. We cannot give heed to them because their patterns are too vague for definition. They may have their beginnings, and their endings, and as processes of behavior they may constitute as true a circuit as any overt response, but they can be learned only as the accompaniments of explicit responses to which we give heed. The phenomena of these implicit responses are usually called *feelings*, or, more precisely, affections and emotions.

Imagery, on the other hand, belongs to an explicit neural response to which we give heed; but since the behavior is that of reflection rather than of overt action, we shall treat it under the heading of memory.

In this chapter we are considering the part played by affection in behavior. Vague though these phenomena of behavior seem to be, they are neither negative nor negligible. On the contrary, affection is a positive feature of instinctive response, and is, in truth, the æsthetic criterion of adjustment.

The elusive character of affection is very tantalizing to the analytic psychologist. He can devise experiments which seem almost to bring the quality under direct observation, but not quite; for the feeling itself becomes so attenuated that he finds nothing affectional left in his grasp. All that remains is the empty shell of a perceived or remembered figure, the affective tone of which has vanished. Not only is an important "content" of experience left undescribed and undefined, but the failure to devise a method adequate to these ends casts some doubt upon the validity of the entire method of psychological analysis. If our attempts to describe and define our feelings utterly destroys them, may not the descriptions and definitions of sense-perception and imagery also falsify or destroy the concrete experiences to which they refer?

It has been customary to regard the phenomena of experience as capable of analysis into separable ingredients, just as it has been thought possible to analyze an act of

behavior into a series of unit-acts. We have already seen that the conception of chained reflexes is invalid, and that an act of skill is something quite different from a summation of simple habits. We ought therefore to be quite ready to regard the phenomena of affection as indivisible wholes, which can be adequately described and defined only in their totality.

In a recent study of clang-analysis [1] it has been demonstrated that the separation of a perceptual whole into its ingredients gives rise to parts which are not what we should expect them to be. It is well known that a musical clang has as its physical counterpart a complex vibration which by physical analysis can be reduced to a series of partial vibrations of definite frequencies and amplitudes. It is also known that under favorable conditions these partial vibrations can be separately heard. These facts have served as a striking instance of one-to-one correspondence between the physical elements of a sound—that is the different frequencies of vibration—and the perception of a clang.

The investigation in question compared the tones analyzed in a specific clang, with separate tones, otherwise produced, each possessing the precise frequency and intensity of that clang's partials. If the clang were a mere combination of partial tones, its ingredients taken separately ought to have been heard as identical with their separately produced counterparts. But this was not the case; for the partial

[1] M. Eberhardt, "Über die phänomenale Höhe und Stärke von Teiltönen," *Psychologische Forschung*, 1922, *2*, pp. 346 f.

tones were invariably found to be much weaker than their separate counterparts. This shows that membership in a clang alters the phenomenal character of the partial tones. We do not hear the partials as loudly as we would if they were separate and distinct tones. In spite of the identical physical conditions, a sound is less intensive when it is a member of a clang than when it exists independently. A phenomenal *configuration*, such as a clang, is both something more than and something different from the sum of its ingredients; for these ingredients are no longer separable entities, but members of a "whole," and being such they must lose some, indeed a great deal, of their individuality.

If, then, even a perception cannot be analyzed into its constituents, we can see how futile must be any attempt to analyze affection into its constituent parts. Instead of concluding that the failure of an attempt to analyze affection discredits the science of psychology, we conclude that analysis has quite another end than the revelation of constituents or "elements" of phenomenal experience. This other end is the creation of new phenomena. Analysis causes the members of a configuration to become themselves individual wholes; and, accordingly, the affective coloration of the old configuration vanishes when the new configuration appears. The conditions of figure and ground having changed, the affection also changes. What was pleasant may now seem unpleasant, and *vice versa*. Furthermore, the change may be from an affection towards an affectional neutrality, and *vice versa*.

These changes, however, are not necessarily abrupt, like the changes of configuration, because affection depends chiefly upon the dispositional ground from which a perception emerges. Consequently, an affectional mood often persists despite sudden and repeated alterations in the field of perception. An entire course of diverse experiences and undertakings may be colored by a dominant mood of sadness or joy. Even an æsthetic impression of beauty may be tinged by the undertone of an unpleasant mood.

These subtle variations of affectional color often make the descriptions of a poet more accurate and significant than those of a psychologist. What we undertake to describe as scientists is always artificially restricted, and therefore more exact than the reality we are describing. An artist, on the other hand, knows no such restriction, and can invoke phenomenal undertones which defy analysis. The question of "mixed feelings" is an instance of this fact. What to a scientist is a contradiction in terms, the poet boldly expresses when he writes that "parting is such sweet sorrow." Psychology must accept the poet's description, and cease to be troubled by the apparent contradiction in terms, because analysis is not the sole method of science. Affection, in particular, can be employed as a functional concept. A description of affectional nuances will then be in order; for wherever affection is involved, experience is livelier, richer, more eventful, and the practical outcome of behavior is in every way more significant than it is in the dryer, harder, more casual atmosphere of affectional neutrality.

In addition to this distinction between affectional and neutral behavior, the contrasting affections of pleasure and displeasure are also functionally significant. Our behavior may be keyed up or down in a manner which is phenomenally registered as pleasure or displeasure. These felt nuances are often as adequate an index or expression of behavior as are the structural aspects which we can describe more exactly in terms of sensation and imagery.

Feeling is a characteristic of experience; but it is a coloration or nuance that belongs to the pattern of experience, not to its members as such. A perception is pleasing in the degree in which its circuit is appropriate to the conditions under which the behavior is called forth. It is in like manner displeasing when desire is thwarted and the circuit disrupted, thrown out of gear, or rendered incomplete in any respect. An affectional neutrality is manifest whenever behavior lacks the glow of spontaneity, that is, when it lacks vitality, as it will in routine habits and in casual observations.

The entire range of instinctive behavior is highly colored, and whenever a situation taps instinctive nature the perception glows with the affective tone of *emotion*. This tone is commonly, though not too accurately, described as pleasant when the action is in the expansive key of *attraction*, and unpleasant when it is in the contractive key of *avoidance*. Other emotions, such as *rage*, *fear*, *love*, *wonder*, *disgust*, etc., are the natural colors of more specific instincts. All emotions are aspects of primitive impulses, and are

inseparable from the patterns of situation-response, which not only indicate their origin but are their being.

The difficulty of describing affective life in definite terms is a difficulty created by our habit of analysis. In order to be concrete we think we must reduce everything to its ingredients. We can distinguish the qualities of experience as sounds, colors, contacts, smells, and tastes; we therefore demand a similar division of our feelings. But this demand is merely logical; it answers no psychological question. Analysis itself is a logical procedure which can answer some questions, but not others. Affection is a case in point; for when we analyze our feelings, we find, perchance, no feelings at all, but only certain qualities of sensation.[1]

To repeat: we analyze what we can, and in so doing we create new perceptions; but the form and color of perception is, and remains, unique and unanalyzable. All we can do, or need to do, scientifically, is to state the conditions under which each experience of behavior arises.

§ 38. *The Pedagogy of Affection*

The inferences we are justified in drawing for the pedagogy of affection and emotion are positive to this extent, that a lively affection attaches itself to all real and vital undertakings. Whenever a living organism participates freely in what it is doing, the conditions are those of affectional enrichment. In as much as this endeavor finds its most significant criterion of adjustment in the æsthetic

[1] Cf. J. P. Nafe, "An Experimental Study of the Affective Qualities," *American Journal of Psychology*, 1924, *35*, pp. 507 f.

feelings, it is apparent that the first principle of sound pedagogy is to seek tasks that will engage students in real undertakings. The primal motives for these undertakings must be sought in the instinctive wants of human nature. When these are tapped, we can be sure that an affection will be aroused that will serve as a criterion of adjustment. This does not mean, however, that the proper method of instruction consists in first arousing fear, anger, love, etc. The task, and an adequate configuration for its fulfillment, are always primary considerations in education. Affection and emotion must never be allowed to dominate the situation; on the contrary, they should be summoned only as means to fulfillment. A primitive rage is of no avail, whereas a fighting spirit to overcome obstacles is an important adjunct to a distinctly educational task. So, too, in the case of other primary wants; the allaying of fear, the satisfaction of curiosity, the primitive contentment of love, may each stimulate the fulfillment of any task that is real and therefore worth undertaking.

As regards the affectional variations of pleasantness and unpleasantness, these, too, must be held in place as means of furthering and hindering appropriate and inappropriate responses. An overemphasis upon pleasure for its own sake is enervating; while the constant emphasis of an unpleasant situation from which one is moved to extricate oneself brings in its wake a distaste for learning, and may lead to the more serious consequences of repression and avoidance. Neither Epicureanism nor Stoicism is con-

ducive to sound pedagogy; nor does the psychology of affection warrant either of these divergent views of life. Pleasure is not necessarily a thing to be sought after, nor displeasure a thing to be avoided. Each is an aspect of behavior, serving on the one hand as a criterion of fulfillment, and on the other hand as an index of reality which guarantees that the moment of experience or the course being pursued is not perfunctory but something of vital importance to the psychophysical organism.

§ 39. *Sentiment*

The organization of the affective life is a matter of profound importance. Character has its roots in emotion, and the control of instinct is therefore a major problem of education. To be able to feel the finer nuances of adjustment, and, at the same time, to avoid the excesses of passion, which "carry one away," or put one "beside oneself" with anger, fear, or love, is no mean achievement. If we do not keep the channels of original instinctive impulse open, we lose enjoyment and that quickening effect of action which satisfies deeply felt needs. But to keep these channels open to every current is to invite disaster.

The organization of instincts and their emotions is a problem of learning akin to the acquisition of skilled movements. We must hit upon a "right rhythm" and preserve it, employing the æsthetic criterion as our means of selection. Each instinctive impulse defines its own pattern, and if left to itself will "persist with varied effort" in working

this pattern out. Organization is but the refinement of a pattern of instinctive behavior, which converts a blind impulse of rage into a moderate feeling of aggression. As this refinement takes place—not only gradually, as a result of the slowly altering conditions of disposition and the background of experience, but also suddenly when the behavior acquires a new focus or a new shape—the emotion is transformed into *sentiment*,[1] and we feel the rhythm of our anger without being carried away by it. Furthermore, organization will combine diverse instincts into a single pattern, and conflicting passions into a subtle rhythm that embraces in its single course the lover's alternate aggressiveness and shyness, his anxiety for the loved one, and his deep laid sympathy.

The gamut of affective organization extends from the blind passion that accompanies uncontrolled impulses to a refined nuance of feeling for a rhythm that no longer knows its source. To this latter group of sentiments belong the enjoyments of contemplation, involving the passive participation of a spectator who watches with lively interest but does not himself engage in what is going on. The enjoyment of Art falls in this category, and so do many of our happiest moments of reflection. For we can give ourselves over to the rhythms that we have learned to extract from our impulses quite as well as we can be carried away by the crude impulses themselves. Our æsthetic criteria, and our

[1] A constructive theory of the sentiments has been worked out by Alexander Shand in *The Foundations of Character* (1914). Cf., also, William McDougall's *Social Psychology* (1914), pp. 121 f.

ability to *empathize*[1] a situation by projecting ourselves into its rhythm, afford means of insight far more direct and more real than any reasoning and deliberation can supply. When I contemplate the plains of a flat country, I participate in the rhythm of flatness, and feel myself stretching out towards the horizon of the landscape. Likewise, if I contemplate a graceful tower, I participate in its upward flight, and feel myself rising with it towards the sky. These empathic experiences are life-giving agencies; they mark goals, and set criteria for our behavior amid less satisfying surroundings.

The baneful effects of sentiment appear whenever it degenerates into *sentimentality*. Here we have the cultivation of a habit of mind which, to quote George Meredith, marks a sentimentalist as "one who seeks to enjoy without incurring the immense debtorship for a thing done." The sentimentalist converts all perception into its shapes and rhythms, regardless of their rightness. Consequently, everything is superficial, easily lumped into vague and amorphous patterns, the contours of which are never clearly defined, because no effort has been made to learn the true basis of perceptual organization. The sentimentalist lives in clouds of words, colors, and sounds, suggesting vague and unreal forms, which he takes at their face value. He is neither an actor nor a thinker, but merely a *feeler*. He does not act;

[1] *Empathy*, a translation of the German term *Einfühlung*, has been widely used in modern æsthetics, particularly in the writings of the late Theodor Lipps. For a discussion of the subject in English, cf. Vernon Lee and C. Anstruther-Thomson, *Beauty and Ugliness* (1912).

instead he avoids the urgency of his impulses by splashing about in a sea of sensation and imagery with which the phenomena of his experience supply him. His character lacks solidity of texture, and we call him insincere.

Between the extremes of this gamut, which extend from blind cravings on the one hand to the highest levels of contemplation on the other, the way of education is marked by the most varied application of affective criteria to all our undertakings. The task of organizing our lives, which is the problem of education, cannot be completed, much less undertaken, without a feeling for the rhythms of behavior, and the balance and proportion of all acts performed, and all things seen. Affection is, therefore, a highly important feature of education, because enjoyment and pain are indices of personality and character.

CHAPTER XI

SENSATION

§ 40. *Affection and Sensation*

Since the sensory aspect of perception can be focalized, psychologists have often tried to describe perception in terms of sensation. This method of procedure, however, is based upon the assumption that a perception can be analyzed into elements which *are* the perception. Having found reason to doubt whether any psychological or physiological process is ever a mere sum of elementary constituents, we have denied this assumption, and have maintained, instead, that every process is a unitary whole, in the differentiation of which new wholes are created. We have been able to trace the creation of these new wholes in the course of both phylogenetic and ontogenetic development. Among the differentiations which take place in the behavior of an individual certain events emerge with a compactness and completeness that defines their phenomena as perceptions.

As we come now to a consideration of the sensory aspects of perception we must hold fast to the reality of perception as a circuit of behavior, otherwise our analyses will lead us into the differentiation of phenomena that are quite artificial. Whenever we observe the sensory quality of a perception—its color, its sound, its taste, etc.—we are able to

achieve a higher level of integration in our behavior. We respond no longer to a situation the members of which are undiscerned; instead, we give heed to the qualities we observe. But observation carries us still farther, for we can see colors, hear sounds, smell odors, etc., quite apart from the experienced behavior in which these occur. Observations of this sort are still perceptual, still a kind of behavior, but the behavior is no longer that of achieving practical ends. Arrangements of pure color and pure sound give rise to art and music; but art and music are contemplative, not practical. While all such artifacts have their proper setting and their appropriate uses, we cannot be too insistent upon the distinction between the practical and the contemplative; because the creation of independent sensory contents and their arrangements do not supply us with an understanding of growth and development. Since education transforms crude into refined behavior, the process is obviously one of differentiation; but a differentiation which does not at the same time integrate its data into more completely balanced forms of behavior is abstract and impractical. As students of behavior and of its improvement we must therefore consider these differentiated entities of mind and body, not *per se* but *per agens.*

Like affection, sensation is an aspect of perception; and in immature minds the two are inextricably combined. Although a primitive perception lacks the articulateness of a highly integrated whole, it has both affective and sensory aspects. Affection, as we have seen, is a perceptual

coloration which depends in large measure upon the disposition of the person affected and the context in which the perception arises. Sensation, however, depends upon psychophysical conditions that permit us to trace correlations between the stimuli—such as light, sound, and pressure—the physiological processes of the sense-organs—such as the eye, the ear, and the skin—and the sensory phenomena themselves—such as color, tone, and touch. With the aid of this method of correlation a sensation can be defined, whereas an affection does not lend itself to such a procedure. Degrees of pleasantness and unpleasantness do not have sharply drawn contours, the spread of feeling being conditioned not only by the structure of the perception but also by the background of predisposition—both instinctive and acquired—upon which the act of behavior and its perceived form arise.

§ 41. *Attention*

The sensory aspects of perception are more fully determined by the structure of the phenomenal figure than are the affective aspects. Although the background from which the figure emerges is never a negligible factor, it can be rendered sufficiently constant so that variations in the structure of the figure are separately observable. For example, the tobacco-box on my table is not merely a green colored object, for it has gold bands, a red seal, black and gold letters—all of which are separately discernible. When the conditions are such that the structure of an object is observed, in whole or in part, we have what we call a state

of *attention*. From this point of view attention is neither a mysterious faculty which clarifies the contents of an experience, nor an independently variable aspect of the phenomenal contents of perception; instead, attention is synonymous with the perception of a "good" figure, the structure and contour of which are articulate and definite.

When we speak of attention in a practical sense, as we frequently do in education, we have in mind the promotion of conditions favorable to the observation of good, cleanly-cut figures. Since the delineation of a figure is given by the sensory aspect of the phenomenon, attention requires both a constant background and the presence of something upon this background that is calculated to define itself. The education of attention is concerned with (1) the disposition or attitude of the observer, who must hold himself constantly to the task in hand, be ready for the appearance of relevant data, avoid "woolgathering," and preserve a background favorable to the definition of configurations of a certain type. The education of the attention is also concerned with (2) the structure of the object observed; because we are dealing with an intrinsic feature of the figure, which may either be of a sort to command the attention at once, or be so constructed that only a favorable background will bring out its structural details.

From a common-sense point of view, attention seems to be a capacity to do certain things to the objects of perception; but pedagogy can be led astray if too much emphasis is

placed upon the potency of attention. As a matter of fact, no special capacity is involved other than that of behavior itself and its phenomenal patterns. In order to secure adequate attention for learning and understanding one must build up dispositional attitudes of readiness for certain forms of behavior. The matrix from which these attitudes arise is the "all-or-none" response, which bifurcates into the responses of attraction and avoidance, and thenceforth into the varied desires and cravings that constitute original propensities of selection. On the other hand, the objects which are discerned, and thus, as we say, clarified by attention, emerge by virtue of their intrinsic completeness of structure. What a skillful teacher does is to fit the object to the psychophysical disposition of his pupil; which means selecting objects appropriate to the intelligent behavior of the learner. A gradual refinement and expansion of the learner's readiness goes hand in hand with the refinement and increased range of the objects discerned and clarified. Attention is only another word for the phenomenal definition of the contour and inner articulateness of a perceived figure.

§ 42. *Sense-Differences*

Variations in the configurations of behavior, as indicated by contour and inner articulation, constitute a basis for certain categories of perception, the most fundamental distinction being that of sensory *modality*. Perception falls naturally into modes of *seeing*, *hearing*, *tasting*, *smelling*, *touching*, etc. Of these modalities, the most primitive, as

well as the most universal, is the sense of contact. We find the behavior of all living creatures more or less differentiated with respect to contact. The behavior will vary with the *location* of the contact upon the organism, and with the nature and intensity of the contact. The most important qualities of contactual experience appear to be those of *pressure*, *warmth*, *heat*, *cold*, and *pain*. Somewhat higher in the developmental series of animals are found the chemical senses of *taste* and *smell*, and the response to light with its qualities of *vision*, colored and uncolored. The last sense to differentiate itself, both in the phylogenetic and in the ontogenetic course of development, is that of *hearing*.

Upon the basis of sense-modality a number of sense-differences accrue in the course of development and learning.

I. Subject and Object

The first to be noted is the differentiation of subject and object, or the behaving organism and its environment. A primitive response is relatively undifferentiated; and so, too, is its sensory quality. The phenomena of sensation and affection are not at first separated; neither are the different modalities of sensation simultaneously involved in the behavior. But, however crude and amorphous it may be, the primitive response of a behaving organism is a single dynamic pattern, embracing aspects capable of setting the organism off from its environment, just as it embraces the possibility of differentiating sensation and affection.

The changes that take place in setting the organism off from the environment to which it reacts accompany growth

and maturation of the nervous system and sense-organs. According to the capacity of the psychophysical organism under consideration, these changes find expression in circuits of behavior which, as they become articulate, leave affection and the inner organic sensations behind as a dispositional matrix of receptivity, while sensations of peripheral origin, such as touch, taste, smell, seeing, and hearing, become a means of information about the outer world. Thus, the total-response of the organism with its vague feeling and sensation is transformed into a more or less permanent subject which receives and reacts to a variety of objects coming from without.

II. Sensory Gradation

In addition to the distinction of subject and object, the phenomena of sensation include numerous qualities which grade one into another. These constitute self-contained series belonging to the separate sense-modalities. In sound, for instance, we have the graded series of pitches from high to low; and in vision, the color band of red through orange to yellow, through olive to green, through robin's-egg blue to pure blue, and through indigo, violet, and purple back again to red. Gradations are found also in the achromatic series of grays, and between the chromatic and the achromatic tones. Similar gradations appear in taste, smell, and touch.

These gradations are phenomena that accompany development, and vary both with the nature of the organism, and with its education. In the case of vision, the first differentiation in the behavior of a human infant is made between

light and darkness. Immediately after birth a light stimulus in a dark room is effective in producing fixation of the eyes upon the source of light.[1] Some time later the infant will fixate and respond to "warm" colors, red and yellow, in preference to "cold" and non-colored objects. A third step in development is taken when the child shows a special sensitivity to the "warm" colors as distinct from the "cold" blues and greens which are now accepted as colors differing from non-colors. From this point onwards, the finer distinctions of principal and intermediate colors, and their relations with the achromatic series, are gradually compassed until the individual has at his command the differences of color-tone, saturation, and shade, which make up the complete series of chromatic and achromatic phenomena.

The point of interest here is the progress by successive stages in the development of more and more articulate visual qualities. The first crude selection of light is succeeded by a selection within the lighted field, of certain colors against non-color, followed by a selection of "warm" against "not-warm" color, and, finally, the individuation of colors: "warm," and "cold," principals and intermediates. At the same time the fields of darkness, of non-color, and of "cold" color, which serve successively as grounds for the new differentiations, become themselves more highly articulate. A child does not cease to see darkness when he becomes able to distinguish chromatic from achromatic light, nor does he cease to see achromatic phe-

[1] Cf. J. B. Watson, *Psychology*, pp. 264 f.

nomena when he becomes able to distinguish "warm" from "cold" colors. Instead, all these finer distinctions of a previous level become more articulate and more highly integrated. This genetic development seems to signify an improvement in the response made to graded differences, which can be expressed as a lowering of the threshold of discrimination between light and dark, color and non-color, "warm" and "cold" colors, reds, yellows, greens, blues, and their intermediates.

A similar genetic series of gradations is, in principle, to be expected in every sense-modality; but the distinctions are not so clear-cut and univocal in the other senses as they are in vision. In hearing, however, the first crude differentiation of noise from stillness is succeeded by the gradation of high and low pitch, within the scale of which vocalic regions of pitch seem to afford an intermediate stage in the genesis of the more precise tones and intervals employed in music.[1]

III. Sense-Images

A third genetic differentiation of sensation concerns sense-images and their origin. We have pointed out that the original configuration of a psychophysical response is at once subjective and objective, sensory and affective. From this matrix there arises a configuration which can exist phenomenally as a *veridical image* of what has taken place, even after the external conditions of its arousal have ceased. These veridical images, which carry over the original experience into a phenomenon of memory, have been called

[1] Cf. the writer's *Hearing* (1924), pp. 108 f.

"eidetic" in order to distinguish them from the ordinary recollections of adulthood which, in comparison, are pale and immaterial.

It is a common assumption that the imagination of a child is remarkably rich and detailed; and investigation indicates that the assumption is well-founded.[1] Not only are children more prone to imagery than adults, but their images possess a verity that is lacking in the mental pictures of later life. Roughly speaking, these veridical or eidetic images give way in adolescence to the sense-images, which we call positive and negative after-images, and to the images of memory and of creative fantasy, which, though significant, rarely suggest reality.

It appears, then, that a sense-impression not only exists while perception is taking place, but can live on, and recur from time to time as an eidetic image possessed of the same phenomenal verity that attaches to perception. Only after practice has proved the unreality of these memorial effects does the configuration lose its verity and become reduced to the status of a mere vehicle of thought and imagination.

The three types of development thus far traced in the object of perception, namely, the sense-modalities, the gradations of quality within these modalities, and the sense-images that carry beyond the limits provided by the external conditions of arousal, all show marked differences

[1] Cf. E. R. Jaensch, editor, "Über die Vorstellungswelt der Jugendlichen und den Aufbau des intellectuellen Lebens," *Zeitschrift für Psychologie*, 1920–22, *84*, *87*, *88;* also Oswald Kroh, *Subjektive Anschauungsbilder bei Jugendlichen* (1922).

from individual to individual, and also from race to race. Individual differences are attributable to the species of the organism, and to its level of growth and development; but they are also largely determined by social and racial conditions. The concept of *culture* is very closely bound up with this genesis. It is not a finer sensitivity, as this term is ordinarily understood, that makes it possible for the savage to guide his course unerringly in the trackless forest by means imperceptible to civilized man. On the contrary, his senses of sight, hearing, etc., need be no more acute than those of his more highly civilized brother. What distinguishes his behavior are the configurations of perception that he finds significant. This distinction rests particularly upon the genesis of his sensory gradations, which remain largely in the concrete setting of practical behavior, and are less often employed in abstraction as categories of reflective thought. In order to understand the life and behavior of peoples different from ourselves, including our own children, we must first try to understand the significant configurations of their mode of perception. Concerning the mental operations of primitive people, Wertheimer remarks that they are both less and more effective than the logical operations we employ: "less, in that certain operations of thought commonly used by us are altogether excluded from consideration; more, in that the thinking itself is in principle more intimately concerned with real things."[1]

[1] Cf. Koffka, *op. cit.*, p. 335.

§ 43. *The Qualities of Sensation*

We are now ready for a survey of the "five" senses. We shall treat the subject briefly, since it is one that is fully discussed in all books on general and experimental psychology. Our present interest is confined to the more outstanding gradations found in the five most important modalities of sense, because it is by a discernment of these gradients that behavior becomes integrated and experience enriched.

I. Touch

The senses of the skin, muscles, tendons, and joints, and of certain internal organs of the body are observed as qualities of *pressure*, *pain*, *warmth*, *heat*, and *cold*. When experienced as an after-effect of sensation without adequate external stimulation, these senses give rise to veridical images of the eidetic type. This fact indicates that these senses are still primitive and relatively undifferentiated. A further complication that renders a clearly differentiated image of this modality difficult to observe is the persistence of sensory stimulations from within the body. Since these are all senses of contact, a perception can be aroused by internal as well as by external stimulation. Circulatory changes and the innervation of muscles will occasion the same sensations of the skin that are otherwise produced by contact with external objects. It is therefore difficult to obtain a pure image of this modality without actual sensory contamination. When I try to imagine a touch on my hand I am able to perceive the region of the hand upon which the imaginary touch is to be received. Thus my

image of touch is in part perceived like any other sensation. For practical purposes I can still distinguish between internal and external stimulation, and thus draw a line between myself and the outer world at the periphery of the skin, but my images of touch remain eidetic; perhaps because I find no occasion to develop a more refined discrimination between the sensory and the imaginal data involved.

II. Smell

The sense of smell is probably the earliest special sense found in vertebrate forms of life. The connection of the sense-receptors of smell with the olfactory lobes of the brain, which control sex-life, procreation, nourishment, and excretion, indicates the intimate bearing of smell upon all these important functions of life. The qualities of smell are numerous and hard to distinguish. An interesting attempt at classification has been made by Henning,[1] who refers all possible odors and their gradations to the surface of a prism (see Fig. 3). At the six corners of this prism he places the outstanding odors of his system, namely: *spicy*, *burnt*, *resinous*, *flowery*, *foul*, and *fruity*. He then maintains that intermediate odors occur between any two, three,

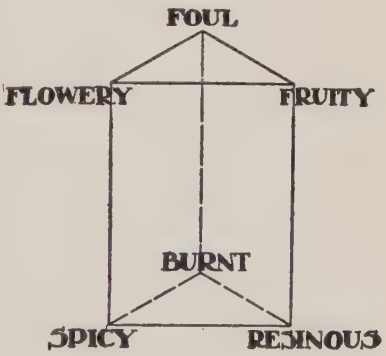


FIG. 3.

[1] *Der Geruch* (2nd ed., 1924).

or four odors which the structure of the prism would allow. Thus we might have a resinous odor which is also spicy and burnt, but we could not have a resinous odor that is at once spicy and foul.

III. Taste

The qualities of taste—which are more definite than those of odor—are by general agreement, *sweet*, *sour*, *bitter*, and *salty*. Henning, who has investigated this sense also,[1] suggests that the gradations of these four qualities can be classified with reference to the surface of a tetrahedron, each corner of which is designated as one of the four principal tastes (see Fig. 4). Again we have the possibility of intermediate tastes between any two of the principal qualities, and mixtures of any three, but not of all four.

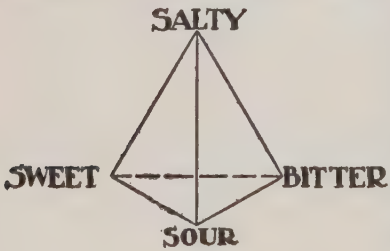


FIG. 4.

Henning maintains that in addition to taste in the mouth, occasioned by liquid stimuli, there is also a nasal taste occasioned by gaseous stimuli acting upon special organs in the nasal passages. These latter stimuli give rise to the same qualities of sweet, sour, bitter, and salty that are produced by taste in the mouth. Thus we can actually smell the sweet odor of a sugar factory, the saltiness of the

[1] Cf. "Psychologische Methoden zur Untersuchung des Geschmacksinns," in Abderhalden's *Handbuch der biologischen Arbeitsmethoden*, Abt. VI, Teil A, Heft 4, 1922.

sea, the sourness of a lemon, and the bitterness of essence of almonds (benzaldehyde). According to Henning, the images of both taste and smell are always eidetic, which again points to the primitive and undeveloped nature of these senses.

IV. Vision

In contrast to the lower senses which have been described, the higher senses of vision and audition are much more clearly differentiated with respect to variability of gradation. Consequently, their perceptual configurations are both more numerous and more definite.

In the case of vision the qualities fall into two series, the achromatic and the chromatic. The achromatic series grades from black to white through intermediate grays, while the chromatic series of the spectrum constitutes a band of colors, the violet end of the spectrum showing marked resemblance to the red of the other end. Phenomenally, the band completes itself in a circle when we supply the intermediate purples that lie without the visible spectrum. In this continuous phenomenal circle there are four outstanding colors, *red*, *yellow*, *green*, and *blue*, of which it can be said that no one resembles any one of the other three. In order to give emphasis to these four colors the circular band can be modified into a square, the four corners of which will designate the four principal colors, while the lines will indicate the intermediate colors that lie between.

Since colors vary, not only in hue but also in shade or tint, and in saturation from the neutrality of sheer grayness to full color, it is apparent that the two series of achro-

matic and chromatic sensations must be brought into relation with one another. This relation can be shown graphically with the aid of a double pyramid, the base of which, with its four corners, represents the color square, and the axis, the unilinear gradation from black through gray to white (see Fig. 5). Unlike Henning's geometrical figures for taste and smell, the color pyramid indicates qualities of vision, not only upon its surface, but throughout its interior dimensions.

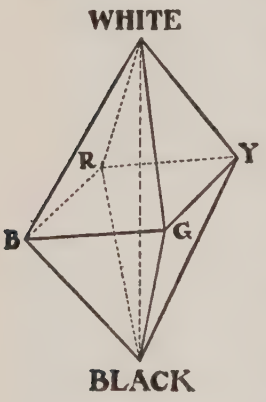


FIG. 5.

We must not be misled by graphic representations, as we should be if we were to suppose that these schemes of gradation are necessarily ultimate and fundamental to sense-perception. In the case of vision it is all too easy to infer that admixtures of the six colors which designate the corners of the pyramid, namely, black, white, red, yellow, green, and blue, constitute a basis for all the visual phenomena of experience. In contradiction to such an assumption it has already been stated that vision generates from a bright figure upon a dark ground. In this bright figure a "warm" color is more effective than a neutral brightness. At first the green-blues are not differentiated from grays, and even after they are perceived as colors they are "cold" colors before they are greens or blues.

The after-effects of sight in childhood seem to be chiefly eidetic. Perhaps they are exclusively so up to a certain

age. The investigation of this subject made by Jaensch and his associates [1] leads Henning to suggest that the most primitive phenomena include no distinction whatsoever between perception and recall.[2] From this phenomenal original develops the distinction between perception and its eidetic image. The image, at first veridical, is later subject to further differentiation into sensorial after-effects—the so-called "after-images," positive and negative—and into the phenomena of recall, which lose their veridical character and become the ordinary images of memory and imagination.

V. Hearing

The sense of hearing affords at least five kinds of gradation. In addition to its qualities of volume, loudness, and duration, it has two special qualities of *pitch* and *brightness*. Pitch varies with the vibrational frequency of sound. Rapid vibrations give high pitch, slow vibrations low pitch. Brightness, on the other hand, is a variable of sound-structure. When pitch emerges as a salient feature of sound, the effect is that of brightness. When it fails to emerge clearly, and the sound is muffled or smooth, the effect is that of dullness.

These distinctions enable us to describe different types of sound. Tones give definite salient pitches, whereas vocables are dull, and their pitch is regional rather than definite. Noise may be either bright or dull, but its pitch is always indefinite. As already stated, noise appears to be

[1] Cf. note, p. 168.
[2] Cf. *Der Geruch*, pp. 297 f.

genetically prior to the more definite configurations of vocable and tone. At a primitive level of perception we should have gradations between voluminous noises and non-voluminous noises, loud noises and weak noises, long noises and short noises, high noises and low noises, salient bright noises and muffled dull noises. These gradations are all more or less interdependent. Since both volume and pitch are conditioned upon vibrational frequency, a voluminous noise will always be of low pitch, and a non-voluminous noise of high pitch. In the same way, a salient brightness is never found in sounds of slow frequency, or a muffled dullness in sounds of high frequency. Since, however, noise can be produced by vibrations that include a wide range of frequencies, all these phenomena may be fused in one indefinite pattern.

When the conditions of development permit of finer differentiation, the range of pitch, brightness, and volumic difference leads to the establishment of specific gradations. After the establishment of a rude scale of noise from low to high, particular regions of this scale are perceived as characteristic of certain sounds uttered by the human voice. The vowels, in particular, have a more definite structure than the noises, certain regional frequencies in an ascending series being requisite for the sounds of *u* (moo), *o* (mow), *a* (ma), *e* (may), and *i* (me). From this stage onwards, the more precise differentiation of salient pitch, together with steps or intervals determined by differences of volume, makes possible the apprehension of a musical scale and its employ-

ment in the more refined enjoyment of the properly constituted musical sounds.[1]

Despite the unique qualities of sound, which make it difficult to express their gradations in graphic form, as has been done in the case of the other special senses of smell, taste, and vision, the variables of audition indicate the same kind of order and direction in their course of development that has been found to characterize each of the other sense-modalities. Like the other senses, too, the images of sound may be either eidetically real, or substitutive and representative, as vestiges of something heard, or indications of something imagined.

[1] Cf. the writer's *Hearing*, Chapters III–VIII.

CHAPTER XII

MEMORY

§ 44. *Types of Revived Experience*

Memory is the revival of experience, either as an image, or as a functional reinstatement of previous behavior. Every act of behavior modifies the psychophysical organism, and these modifications make their effects known in later action. The after-effects are of two kinds, *dispositional* and *reproductive*. The effect upon disposition is the more general and inclusive; for in undergoing behavior the organism becomes disposed not only to behave again in the same manner, but also to revive the phenomena which accompanied this behavior. Original propensities, which we have described as instinctive, become articulate, and new propensities are formed which become habits. The retention of these changes as more or less fixed ways of doing things and fixed ways of looking at things is the chief function of memory.

In addition, memory is the revival of previous experience in the form of *images*. We have already noted the existence of these images in our discussion of sensation; and also the fact that the revivals of childhood retain the veridical character attaching to the sense-perception from which they derive. This *eidetic disposition*, as it has been called, ap-

pears to be the rule in early childhood. While an eidetic image is not necessarily a complete reproduction of the perception in which it originated, it possesses, nevertheless, a vividness which puts a child under no necessity of differentiating it from actual perception. When, however, it becomes necessary to draw a line of distinction between the function of perception and the function of imagination, the revival loses its veridical character. This line can be very clearly drawn in vision, and in audition, but never so clearly in taste, smell, and the general bodily senses of the skin and internal tissues.

As an indication of the veridity of the eidetic image, Krellenberg [1] cites the case of a very gifted boy of nine years, who, when he saw a negative after-image for the first time, asked the experimenter how he had managed to change what had previously been a red object into a green one. In childhood the negative after-image may be as veridical as the positive image that precedes it, so that the form of the originally perceived object is still seen as it was perceived, although its color and brightness have been reversed. These hallucinatory effects of childhood do not last, however; and the growing child soon comes to differentiate a perceived reality from both its positive and its negative after-images. The so-called after-images—which are most conspicuous in the modality of vision—are, of course, sensory in their nature, and although

[1] Cf. P. Krellenberg, "Über die Herausdifferenzierung der Wahrnehmungs- und Vorstellungswelt aus der originären eidetischen Einheit," *Zeitschrift für Psychologie*, 1922, *88*, p. 64.

they come and go intermittently, they follow closely upon the sense-perception from which they originate.

Images of recollection and of creative imagination, on the other hand, seem to be of central-nervous origin. They appear also to be at first eidetic in nature, but as the child learns to place them in memory, or to know them as products of imagination, they lose their veridity. As already stated, the ability to draw these distinctions depends not only upon individual propensity and education but also upon the sense-modality employed. Observers agree that visual and auditory images, both of memory and of imagination, can be altogether lacking in veridity, although these images are of modalities in which "visions" and "hallucinations" of the most impressive veridity are to be found. In other sense-modalities, however, it has been maintained that no images other than eidetic are ever experienced. The statement does not mean that the remembrance of the odor of violets, let us say, carries with it a conviction that we are actually smelling flowers, but it does mean that the image of the odor, however weak and elusive it may be, is quite as veridical as if it were being perceived.

The investigation of the subject has given certain indications regarding a genetic sequence of development in the different types of imagery; but the data are not as yet sufficient to warrant final statement. The sequence is certainly not that of a simple course of development from sensation to imagination, but a change which takes place in the configurations of behavior. In quite primitive behavior

no objective at all is defined, either sensory or imaginal. When in the course of development an objective is defined, it may be either sensory, or imaginal, or both. The finer discriminations we learn to make between perceived, remembered, and imagined objectives, between the "real" and the "hallucinatory," and between types of images as eidetic and noneidetic, memorial and imaginary, are all functions of behavior. Without realizing this fundamental dependency upon behavior we cannot proceed to a satisfactory analysis of any phenomenal object. Since every phenomenal object depends both upon its ground, and upon the configuration of behavior in which it occurs, the more original the type of the phenomenon the closer and more intimate will be its dependency upon its phenomenal and its biological context. Consequently, many of the interpretations we place upon the phenomena of the child's mind are quite erroneous, because we assume for them the same invariable setting which we as adults have acquired, but which the child does not yet command.

As an illustration of the significance of context in the interpretation of a phenomenal figure, I may cite the case of an hallucination coming under my observation, to which I have referred in a previous book.[1]

A patient, suffering from a serious illness which interfered with his power of speech, complained through written communications that *animated figures* hovered about the head-board of his bed. At the time, in order that the light

[1] Cf. the writer's *An Introduction to General Psychology* (1914), pp. 129 f.

from the windows should not disturb him, he was lying with his head at the foot of the bed; and he was asked to sketch the animated figures he saw before him. Whereupon he produced a fairly accurate copy of the geometrical design, composed entirely of straight lines, which was outlined in gold upon the central panel in the head-board of the bed.

Whatever may be the interpretation of this hallucination, it is obvious that it cannot be attributed either to an image or to an illusion of the geometrical design which the patient actually perceived. Without reference to the context of the patient's experience we are unable to reconcile the report of "animated figures" with a sketch which reproduced with sufficient accuracy what any normal person must have seen upon the head-board of the bed.

§ 45. *The Laws of Memory*

The conditions under which a phenomenal revival of memory occurs can be stated in three laws: (1) *The Law of Perseveration*, (2) *The Law of Association*, and (3) *The Law of Practice.*

I. *The Law of Perseveration* is that any perceived configuration, the articulateness of which is marked, will persist for a brief period of time in a state of sub-arousal after the perception is over. During this period of perseveration, although the phenomenon has vanished, the prepotency of its configuration is such that an image of it can readily be recalled, and when recalled will often possess the characteristic we have described as eidetic. That is to

say, a vivid, striking experience is more likely to be recalled within a short time after it has occurred than a less vivid, less striking experience; and when it is recalled it will often possess a veridity, and a photographic fidelity to the original, which are lacking in recollections that are remote in point of time from their origin.

The period of perseveration is always brief, but it appears to be longer in the case of well-articulated figures than it is in the case of vague and ill-defined impressions. During this period of perseveration we have an effect like that of *inertia*, in which the psychophysical processes involved in the configuration become further articulated and consolidated. When the conditions, both of ground and of figure, favor this inertia of the perceptual processes, and no interruption is encountered in the after-period that immediately follows the cessation of stimulation, the residua of the experience become so firmly articulated that a revival, when it takes place, even after a long period of time, brings back the experience with a vividness and a self-determination that are very striking.

We meet with many revivals of this order in everyday life. The catchy tune that runs in the head, and takes possession of us whenever we are not engrossed in something else, is one instance; the infectious quality of a jingling rhyme is another—for instance, Mark Twain's immortal,

> Punch, brothers! punch with care!
> Punch in the presence of the passenjare!

Recollections by old people of scenes and episodes in

youth sometimes appear to possess this quality of insistence and completeness, even with respect to details long since experienced and presumably forgotten. An illustration of this will be given in one of the following sections when we come to consider factors favoring recall.

II. *Association* is usually referred to as the true basis of remembrance. One mentions the Law of Association with some hesitation, because a certain theoretical interpretation of association has become so hardened in the literature of psychology that one can scarcely use the term without implying a system of psychology which, while fast becoming obsolete, still stalks abroad in the modern guise of several "new" psychologies, notably the psychoanalytic school of Freud, and the quite different teaching of behaviorism. Modern theories of association usually imply a "pathway" hypothesis of nervous action. Every possible act of behavior is supposed to be laid down in the nervous system. What we do in learning is to bring certain acts into prominence, in order that these acts, by frequency of repetition, may be connected with one another, and with the situation that calls them forth.

At an even earlier date in the history of psychology than the advent of the "pathway" hypothesis, a similar scheme of association was applied to mental contents in general, and to ideas in particular. It was held that if one idea, A, happens to occur with another idea, B, either simultaneously or in close succession, an association is formed between them. If, thereafter, either A or B occurs

by itself alone, the other will be likely to recur in memory. If I meet Mr. Jones and his wife together, and later I meet Jones alone, I am apt to recall his wife, because the two were formerly associated together.

There can be no doubt that revivals in memory are motivated in some such manner as this; but it does not follow that any two objects of perception must become associated whenever they occur together, or in close succession. Because I met Jones and his wife together, I do not necessarily recall his wife whenever I see him alone; still less, the dog that accompanied him the first time we met, or the urchin who chanced to pass us at the time, or the telephone pole that was within my view as I looked at him, or, indeed, a thousand things which I may have perceived or thought about during my first encounter with him.

The associationists, to be sure, have recognized some of these limitations, and have found a number of special conditions under which associations are more and less firmly established. Some of these conditions will be described later; but they are all based upon an assumption which we must regard as erroneous: namely, that each of the associated acts, perceptions, ideas, qualities, or what not has and maintains an independent existence after as well as before they are connected. If association is an external agency which supplies a kind of glue to unite events that happen together, we ought to inquire into the nature of this glue. The psychologist has usually passed the question on to

physiology; but it is now many years since a distinguished physiologist, Johannes von Kries, pointed out the physiological difficulties in the way of such an assumption.[1]

When, however, the law of association is restated in terms of configuration, all these difficulties, both psychological and physiological, fall away. The law would then read somewhat as follows: Whenever a number of more or less discrete perceptions (or ideas) enter into a configuration, they become joined by virtue of their membership in a whole; the members are thereafter held together, not by the external agency of an associative "glue," but by the transformation which they have undergone in losing something of their individuality and becoming the members of a single pattern. It is, then, the pattern and not the individual contents that constitutes the memorial residuum. Consequently, when one of these members is re-experienced as an individual it will supplement itself in behavior, with or without associated imagery, provided it still possesses the membership-character of a previous configuration. This means that when I meet Jones and his wife, I am not simply encountering two individuals, each with a variety of independent ideas attached to his or her person, but I am meeting a married couple, the pattern for which is different from what it would have been if they were but casually acquainted, and again different from what it would have been if they were but chance passers-by in the street. In remembering Jones's wife, when afterwards I encounter

[1] Cf. *Über die Materiellen Grundlagen der Bewusstseinserscheinungen* (1901).

him alone, I do so because I perceive him as one of a pair—in this case a married couple. The pattern is supplemented, and becomes in effect what it was upon our first meeting, by the recollection of the missing member. If, however, the context in which I encounter Jones the second time is such that I perceive him only as an individual, or as a member of some other configuration—the business firm to which he belongs, or the party, lodge, church, or what not, that he now represents—I do not recall his wife; the previously established association of a married couple once met in the street simply fails to operate.

Thus, we may conclude that the associative law of revival is not based upon sheer contiguity in time or space, but requires in addition the establishment of membership in some configuration. It is the configuration, not the contents as individual impressions, that we remember; in other words, recollection is motivated by the membership-character of an individual, and not by the chance juxtaposition of individuals.

It may be objected that there are, nevertheless, limiting cases in which the mere "togetherness" of individuals is sufficient to establish an association when there can be no significant connection between them. One thinks at once of innumerable experiments in learning and remembering series of nonsense syllables, a material expressly chosen for its meaningless character. But though the meaning we usually attribute to verbal forms is lacking in nonsense syllables, it does not follow that such a series has no signifi-

cance at all. On the contrary, what these experiments have shown is that, in the absence of a representative significance, the learner must devise a pattern of rhythms, or positional references, such as are possible with the graphic, articulatory, and auditory features of the series, before he can learn the series at all. If the instruction be such that the learner can make no use of these aids, he can repeat the series indefinitely without ever committing it to memory.[1]

Another limiting case of association is the so-called "conditioned responses" discovered by the Russian physiologist Pawlow in experiments upon the "psychic secretions" of animals. By means of a fistula in a dog's throat Pawlow was able to measure the activity of the dog's salivary glands by collecting the drops of saliva in a test-tube attached to the fistula. When the hungry animal was shown food, the glands became active; the mouth watered, as we say. The experiment was then tried of associating the exhibition of food under these conditions with the ringing of a bell. After a number of experiments in which the bell was invariably rung while the food was being shown, the experiment was made of ringing the bell without showing the food. It was then found that the salivary glands became active just as they had previously done when food was present. In other words, the secretion had become conditioned

[1] Cf. Kurt Lewin, "Die psychische Tätigkeit bei der Hemmung von Willensvorgängen und das Grundgesetz der Assoziation," *Zeitschrift für Psychologie*, 1917, *77*, pp. 245 f.; also May Smith and William McDougall, "Some Experiments on Learning and Retention," *British Journal of Psychology*, 1920, *10*, pp. 204 f.

by the ringing of a bell, although at the outset the bell had no effect whatever upon this secretion.

Here we have another limiting case of association between stimuli so irrelevant that we might suppose they could not possibly enter into a single configuration. But, just as in the case of the nonsense syllables for which configurations can be established in other ways than by the more obvious patterns of grammar, syntax, and ideas, so here we have the possibility of rhythm, positional reference, and accent in a perceptual pattern, the focus of which is not only visual and odoriferous but also auditory. Even by force of circumstance, without any natural proclivity to assimilate these diverse stimuli into one perception, the establishment of such a configuration of behavior with sound, as well as with sight or smell, as its focus, offers no serious difficulties; whereas some of the inferences drawn from the experiments do. These questionable inferences rest upon the assumption that sound, sight, and smell are and remain discrete stimuli, which, by the action of a mysterious force called association, are simply glued together by frequent repetition. Sight and smell are bound by original nature to the salivary reflex as appropriate stimuli; but sound is able to take over this function after it has been "glued" firmly enough with the other two by repeated experience. If we correct this assumption with the proviso that in order to touch off the reflex the sound of the bell must first enter into some kind of configurative assimilation with the behavior elicited by sight and smell, we can reduce the con-

ditioned response to the terms of our own explanation of association; and there appears to be nothing in the experiments which would deny the validity of this interpretation.

Further tests must be made before we shall be able to state the precise configurative features of such a limiting case of association. That "conditioned responses" are less effective than those of a more natural order is indicated by the rapidity with which learning seems to wane after it has once been established. This fact alone should be a caution to those who, following behaviorism, are inclined to maintain that all learning is fundamentally a matter of conditioned responses. Even if our suggestion that a configuration can be established between diverse sense-modalities meets with the objection that so gross an incongruity as the sound of a bell and the smell of food denies the possibility of a single whole which will embrace them both, we have yet to remember that the conditioned reflex is, at best, a limiting case upon which no generalizations are logically permissible.[1] In other words, the natural behavior of an organism follows congruent lines; whereas the highly artificial conditions of the Pawlow experiment have no counterpart in normal behavior. To conclude that an abnormal behavior can give a true basis for learning would be as much in error as the attempt sometimes made to explain normal mentality from the aberrations of the insane. While the behavior of Pawlow's animals offers many interest-

[1] Cf. George Humphrey, "The Psychology of the Gestalt," *Journal of Educational Psychology*, 1924, *15*, p. 411.

ing problems for psychology, just as do the mental aberrations of the insane, we shall be on safer ground if we interpret the abnormal in terms of the normal—the artificial in terms of the natural—than if we follow an opposite course, and try at once to generalize strange and sometimes limiting cases of behavior which are revealed under unusual conditions of mind and body.

The law of association as restated is derived from the more general law of configuration that controls all phenomena and all behavior. In the case of revival, some feature of a previously established configuration supplements itself by the recollection of other members of the original configuration. The completeness of a recollection is conditioned in many ways; but it may be said that a revival of the original pattern is the major consideration, the supplementation of details with anything like photographic fidelity being secondary and highly contingent. When I am moved to ask, "Where have I seen that face before?" I not only feel the need of memorial supplementation, I may already have something in mind that vaguely draws limits within which the necessary supplementation will have to take place. In other words, the form or plan of supplementation is already laid down before the details have been supplied which give this plan a definite content.

The question is sometimes asked: How can one remember something that has been forgotten? A family name will often elude us because it is a more or less arbitrary adjunct to the pattern of experience in which the name has its

proper place. For instance, I recall a family which I once knew rather well. I remember a variety of experiences belonging to my acquaintance with them; but I cannot recall their name. I try the expedient of reconstructing the name with the aid of the alphabet. As I proceed I find that I am not altogether helpless. The name seems not to have been a long one; and of all the consonants *C* fits best as the initial and *r* as the final letter. I then busy myself trying out vowels and consonants to fill in a pattern of six or seven letters beginning with *C* and ending with *r*. At last I hit upon the name *Conger*, which appears to satisfy all my demands, and I rest assured that this was the name of my former friends. But subsequent events prove that my procedure was not altogether trustworthy. I meet a mutual friend of the family and ask what has become of the Congers since last we met. He replies: "Conger? I know no one of that name"; and then adds: "Oh, yes! You mean the *Culvers* with whom we were together in Paris."

It will be seen from this instance that my artificial method of reconstruction, while inaccurate, led to a pattern very like the original; and that the supplementation of the missing name was not arbitrary, but was subject to the guidance of a readiness for *a name of a certain kind.* This again illustrates our contention that associative recall is not a supplementation of discrete parts, but the reconstruction of a figure within which the parts, or more properly the members, of the figure may appear. Instead of likening

association to a string of beads, each bead recalling the next in sequence, we remember first the string, and then supply the beads as best we can. Rarely do we recall them all; and sometimes there are noticeable gaps—as in the missing name, which, when supplied, proved to be incorrect.

III. *The Law of Practice* is subsidiary to the law of association. It is a well-known precept that "practice makes perfect"; yet practice does not make perfect unless the conditions under which we practice are favorable to a closer and more definite articulation of the configuration we are trying to memorize. A "good" configuration may stamp itself at once upon a mind ready to receive it, no practice at all being necessary for its remembrance. On the other hand, a "poor" configuration, loose-jointed and vague of contour, is not remembered until it has become articulate in behavior or in apprehension. The service rendered by practice is that of furnishing conditions favorable to a closer articulation and consequent fixation of whatever would otherwise be loose and inarticulate in form. The acquisition of skill through the repetition of an act has already been discussed in § 36. The effect of practice in associating objectives that can be separately perceived, as the phases of an act of skill cannot, is of the same order. But instead of acquiring a specific course of action already involved in a more general and amorphous procedure, the practice of repeating a series of objectives, like the words of a poem, creates a whole by uniting a large number of individual responses, each of which may have been

frequently employed in other settings. These individual responses—the separate words, if you like—must be transformed into the configuration of the whole poem of which they are the members. Frequent repetition will serve to emphasize the rhythm, the balance, the proportion, and other formal aspects of the whole, without which the poem could never be committed to memory at all. This practice, or *drill* as it is called in methods of training, is a means of discovering the formal character of a whole consisting of members which in other contexts may also belong to other wholes. The problem of remembering such figures as those of the alphabet, the multiplication table, and the declension of certain verbs is to incorporate individual letters, numbers, prefixes, suffixes, etc., in a single pattern. In order to achieve this end, the particulars thus incorporated must relinquish something of their particularity, and also whatever membership-character they may possess as constituents of other patterns.

Frequency of repetition in a certain setting favors this transformation. Indeed, it is quite impossible to repeat a perception of sight or hearing, a vocal utterance, or a bodily movement, without promoting its articulation. Even the blindest and most stupidly devised forms of drill, if persisted in, will effect some kind of articulation of the members of the performance. On the other hand, the more one stresses the particularity of repeated data, the more difficult it becomes to transform an inarticulate series into an articulate whole. As already mentioned in the previous

discussion of association as configuration, it is quite impossible to commit a series of nonsense syllables to memory unless in our repeated practice heed is given to the rhythm, grouping, accent, positional reference, graphic features, etc., of the series. Practice makes perfect whenever it favors articulation into a whole, and this it does because configuration is a natural law; but it does so with degrees of success that vary with the methods employed by both teacher and pupil.

§ 46. *Factors Favoring Recall*

Not all impressions that are retained in memory are subject to recall; for some memories reinstate themselves only in perceptual situations and as modifications of response, or as eidetic images which are inextricably tied to a perception. Recollection, on the other hand, is the revival of a configuration which has become detached from the behavior in which it was perceived. This detachment was already effected in the perception. We recall, as we say, the things we have perceived; which means that the objects recalled were discerned at the time of perception—although there are instances where this discernment was not complete. Cases have been recorded in which the recollections of a dream, or the vagrant revivals in a state of drowsiness, have led to the recovery of a lost object. This sort of divination can perhaps be explained if we suppose that the loss of the object was registered in the memory, even though it was not perceived. The incompleteness

of the original perception, indicated by the failure to recover the object at the time of its loss, lives on in the memory; and under favorable conditions a gap is felt in the revived situation which serves to motivate an investigation in certain quarters, leading to the recovery of the missing object. What we recall under such conditions is not the loss of the object, but the gap in our experience where the loss occurred. With reference to the definition of perception as an act of behavior, it is perhaps safe to say that all memory depends upon perception. Yet we may include the possibility of recalling not only the *members* of the perception but also the *gaps* that occur between members; because the memorial residuum is not a number of separate impressions; it is a form or shape which the behavior has taken. In many instances of recollection we do not recall the missing member at all; but, as in the case of the forgotten name previously described, we construct something new to fill a gap in an incomplete experience.

Since our present interest is chiefly in the revival of objectives, we shall in stating the factors which favor recall confine ourselves to memory of this kind. The main factors are three in number: (1) the recency of the perception of the objective; (2) the vividness of the objective; and (3) the membership-character of the motive for its recall.

I. Other things being equal, recently experienced objectives are more readily recalled than those which are remote in time. It is comparatively easy to remember the scenes and events of the last hour, and much more difficult

to recall those of a certain hour yesterday or the day before. Indeed, casual happenings disappear, and are irrecoverable after a short lapse of time; whereas special events having a definite articulation, like a visit to the theater, or a social gathering, may possess a considerable degree of cohesion, making it possible to recollect them, even a long time after they have occurred.

A seeming exception to the rule that with time the events of our life fade from memory is found in the forgetfulness of old age, when a loss of plasticity renders recent impressions superficial, whereas the impressions of youth can sometimes be recalled with eidetic veridity. An interesting account of the aberrant recollections of youth is given by W. H. Hudson in his well-known book *Far Away and Long Ago*.[1] The occasion for these memories he describes as follows:

I was feeling weak and depressed when I came down from London one November evening to the south coast: the sea, the clear sky, the bright colors of the afterglow kept me too long on the front in an east wind in that low condition, with the result that I was laid up for six weeks with a very serious illness. Yet when it was over I looked back on those six weeks as a happy time! Never had I thought so little of physical pain. Never had I felt confinement less—I who feel, when I am out of sight of living, growing grass, and out of sound of birds' voices and all rural sounds, that I am not properly alive.

On the second day of my illness, during an interval of comparative ease, I fell into recollections of my childhood, and at once I had that far, that forgotten past with me again as I had

[1] New York: Dutton, (1918) pp. 2 f.

never previously had it. It was not like that mental condition, known to most persons, when some sight or sound or, more frequently, the perfume of some flower, associated with our early life, restores the past suddenly and so vividly that it is almost an illusion. That is an intensely emotional condition, and vanishes as quickly as it comes. This was different. . . . It was as if the cloud shadows and haze had passed away and the entire wide prospect beneath me made clearly visible. Over it all my eyes could range at will, choosing this or that point to dwell on, to examine it in all its details; and, in the case of some person known to me as a child, to follow his life till it ended or passed from sight; then to return to the same point again to repeat the process with other lives and resume my rambles in the old familiar haunts.

What a happiness it would be, I thought, in spite of discomfort and pain and danger, if this vision would continue! It was not to be expected: nevertheless it did not vanish, and on the second day I set myself to try and save it from the oblivion which would presently cover it again. Propped up with pillows I began with pencil and writing-pad to put it down in some sort of order, and went on with it at intervals during the whole six weeks of my confinement, and in this way produced the first rough draft of the book.

And all this time I never ceased wondering at my own mental state; I thought of it when, quickly tired, my trembling fingers dropped the pencil; or when I woke from uneasy sleep to find the vision still before me, inviting, insistently calling to me, to resume my childish rambles and adventures of long ago in that strange world where I first saw the light.

It was to me a marvellous experience; to be here, propped up with pillows in a dimly-lighted room, the night-nurse idly dozing by the fire; the sound of the everlasting wind in my ears, howling outside and dashing the rain like hailstones against the window-panes; to be awake to all this, feverish and ill and sore, con-

scious of my danger too, and at the same time to be thousands of miles away, out in the sun and wind, rejoicing in other sights and sounds, happy again with that ancient long-lost and now recovered happiness!

II. The vividness of the original perception, which made Hudson's recollections of his youth possible, favors both the perseveration of the impression, and the laying down of definite residua upon the basis of which associative recall can operate. *Vividness*, however, is a term that covers a variety of conditions favorable to the articulation of a "good" figure. Broadly speaking, these conditions have to do with the integrity of the perceived figure, and also with a dispositional readiness for its recurrence. The articulateness of a figure is not only a feature of its internal structure, but also of the background or level from which it rises in perception. Consequently, we can list three important aspects of vividness: a) *primacy*, b) *affection*, and c) *integration*.

a. *Primacy* is popularly expressed by the statement that "first impressions are lasting," which means that the first time a unique figure of apprehension or behavior appears, it makes a clearer impression than it does in any subsequent repetition. One of the reasons why, in old age, our reminiscences revert to youth, rather than to the period of middle-life, is the vividness of the romantic events of adolescence, which is generally much greater than that of experiences occurring after disillusionment has begun to set in. The importance of primacy for pedagogy can

hardly be overstated, because if the first impression of a new subject of study is incorrectly apprehended, or bungled in the behavior that belongs with it, the confused or distorted impression left upon the memory may be a serious hindrance to subsequent steps in learning.

It is, of course, obvious that one cannot receive and remember the entire pattern of a new subject from a single perception of it. A sound educational method will see to it, however, that the first step taken is calculated to establish a pattern the outlines of which will neither restrict progress nor be so vaguely drawn as to leave nothing definite upon which to build.

The striking pattern of what, at the time, seems to be an original idea may have a tenacity in memory out of all proportion to its significance. I can recall an incident of this sort which occurred some time prior to my sixth year. When, one morning, the daily newspaper failed to be delivered, my father remarked that something had probably broken down at the printing house. Immediately I inferred that the pen must have broken with which the newspaper was printed; and I still fancy I can see a huge gold pen, set in some sort of machinery, with which I then supposed newspapers to be printed.

New impressions, whether perceived or imagined, possess a vividness which gives them a lasting quality. It is not so much the precise contour and lively detail as an accent of originality that impresses first experiences on the memory. In my own reminiscence, only the large pen has been re-

tained as an image, and it is not a very clear one; yet I seem to feel with assurance that my discovery of the cause for the missing newspaper was made while walking with my father over a certain bridge which led into the heart of the city; and this context lends a reality to my recollection which it would otherwise lack.

b. A second aspect of vividness is *affective*. Impressions that are received with marked pleasure or displeasure are more lasting than those received in a state of affectional neutrality. This is especially the case when impressions are colored with emotion, although if the instinctive nature is too deeply stirred the articulateness of the figure will be impaired. Of impressions made under strong emotion one can often remember a frustrated desire, or the exultation of a satisfied want, without being able to recall the articulate details of the experience itself. When instinctive nature gains the upper hand, and we succumb to the excitement of fear, rage, or love, the particular event may be unwittingly repressed.

According to the Viennese alienist Sigmund Freud, and his followers, unfulfilled desires, since they lack the articulateness that comes only with fulfillment, live on in memory, seeking opportunities for expression, which frequently they find, though never completely, in dreams, and in the "lapses" of everyday life. The things we have not dared to avow furnish motives for our dreams, and likewise fill the gaps in our waking life which occur when we pause and hesitate over a word, or permit our minds to wander freely. Al-

though we may not be ready to accept the Freudian view that unfulfilled desires are springs of conduct which account both for mental disease, on the one hand, and for sublime flights of poetic fancy, on the other, it will be generally agreed that an affectionally toned experience has a very lasting quality, and that whenever we tap instinctive nature our experience is quickened in a way that stamps certain of its features indelibly upon the memory.

The pedagogy of this subject has received extravagant treatment in two directions. On the one hand, the disruptive and repressive effects of extreme emotion have been interpreted as counseling the presentation of every study in the cool, calm light of reason. On the other hand, a belief that the springs of action are always those of passion has counseled an educational method which aims constantly to bring suppressed desires to the surface, thus relieving the tension which otherwise inhibits freedom of expression. One need not accept either counsel. If our conclusions regarding instinctive behavior are sound, then even the cool, calm light of reason is not untinged with emotion, since, like any other behavior, it derives from instinctive sources. Nor need we fear the overpowering effect of emotion upon study, provided that we keep our problems clear-cut and significant. As regards the pathological aspects of suppressed desires, this is not the place to discuss them; but it would be absurd to suppose that a normal course of life can be followed only in the negative sense of bringing suppressed desires to the surface,

in order that they may be fulfilled and thus rendered innocuous.

By arousing in a pupil "good" configurations, suited both to the external environment in which they occur and to the dispositional readiness of the learner, we can feel certain that an appropriate affective coloration will lend to the impressions a vividness sufficient to assure their remembrance.

c. A third aspect of vividness is the *integration* of the underlying conditions of the figure itself. The structure of a "good" figure that can be readily remembered depends upon many conditions of integration, such as favorable intensities, durations, shapes, and qualities, more or less peculiar to the modality of sense in which they occur. These conditions include the *gradients* of perception which account for its well-articulated structure, and its clearly defined contour. Whatever contributes to the integration of a figure lends to the figure a vividness which will assure its tenacity in memory. Certain perceptions, like a suddenly heard shot from a gun, a persistent unchanging hum of machinery, a visual form of unusual shape, or a peculiar, pungent odor, possess an inherent vividness, attributable to their integration, which causes them to be remembered when more significant though less vivid experiences are forgotten.

III. The *membership-character* of a motive for recall is determined by its "belongings." A "motive" always "belongs" to some larger configuration of events. It is the

incompleteness of the motive that leads to reproduction from memory of whatever belonged to it, or rounded it out, in the past. Since every discrete objective has emerged from a larger whole to which at some time it belonged, everything must have many belongings. These belongings are of two kinds, *dispositional* and *articulate*. The dispositional residua of an objective, or of a configuration of events, lead to the revival of backgrounds, attitudes, and spheres of interest, with their appropriate affections. Being itself only a tag of some previous experience, the motive for revival surrounds itself with the setting of the previous events in which it functioned. A feeling of *familiarity* is attributable to dispositional residua of this kind. The revived setting may assist in the definition and completion of the tag, so that the event is re-lived, placed, and dated; or the setting may serve only as a vague suggestion for reminiscence. Sometimes the peculiar coloration of the setting lends familiarity without defining the motive. The experiences of *déjà vu*, or *fausse reconnaissance*, as the French call them, are of this order. We are confronted with something perceived or imagined which seems familiar, although our judgment tells us it is new and never before experienced. The objective, or event, fits into the revived setting, although the setting does not clarify or supplement it in a manner which enables us to place and date it in the past. Sometimes the influence of a revived setting is directed more especially upon a configuration of the lower senses than upon sight and sound, or their representative forms

of word and number. In such cases reminiscence is very real on account of the eidetic character of the contacts, tastes, smells, etc., which are revived; but, lacking the precision of visual and auditory, or verbal and numerical, patterns, the experience remains obscure, undated, and unplaced.

Articulate residua, on the other hand, give rise to specific ideas and references. The motive of revival is supplemented by other members of a previous experience which articulate with it precisely. One word will bring back others that qualify it, or that build a sentence with it. One figure will seek and find others belonging to a total-configuration, the members of which can all be surveyed and accounted for.

As an illustration of these two kinds of supplementation, consider a word like *death* as a motive of revival. The word at once suggests a background of melancholy and philosophical musing; it may also give rise to a linguistic attitude of phonetics or etymology. At the same time, articulate residua will supplement the pattern with concrete examples, like the recent death of a friend or relative, a philosophical or religious thought of death, a definite linguistic synonym or parallel in another tongue, such as *decay*, *slaughter*, *Tod*, or *mort*. These articulate residua are sometimes numerous and conflicting. The dispositional background, together with the present course of events, will often determine which are the appropriate members for recall. A religious attitude will favor one kind of articulate supplementation, and a linguistic attitude another. Occasionally there are definite rules of procedure that

enable us to construct what is needed to satisfy a given want. If *punch* is taken to be the first syllable of a word, it will doubtless lead to completion as *puncheon* or *Punchinello;* whereas if left to itself it will maintain its individuality, and supply the associates needed to define its character as a *blow*, an *instrument*, a *drink*, or a certain *comic periodical*. Similarly, a cross-word puzzle that requires a three-letter word for a *tool*, beginning with the letter *a*, would be satisfied by either *awl* or *adz;* but only the cross-word on the second or third letter can determine which. The more specific and detached the motive of revival, the weaker and looser will be its claim for specific supplementation. Motives frequently employed may have innumerable configurations to which they belong; thus, conditions of attitude, of previous experience, and of present context combine in determining the precise "membership-character" of any detached or specific motive of revival.

CHAPTER XIII

EXPERIMENTS ON MEMORY, AND THEIR APPLICATION

§ 47. *Experiments on Memory*

The experimental study of memory was begun in a systematic way by Hermann Ebbinghaus, who published the results of a long series of investigations in 1885.[1] The method introduced by Ebbinghaus was that of committing to memory series of nonsense syllables varying in length and selected by chance. The nonsense syllable was chosen because it possessed the formal characteristics of a word, yet lacked the associations which cause words to mean different things to different persons, and to suggest different things to the same person at different times. The construction of a large number of nonsense syllables, formed usually of two consonants joined by a vowel, supplied a body of fairly uniform material without meaning. The syllables were separately printed on small cardboard squares which could readily be mixed together. A series of any desired length could then be drawn by chance and placed before the observer for learning. The series thus selected was repeated aloud by the observer until he could say it without looking at the cards. Each repetition was re-

[1] *Über das Gedächtnis*, Leipzig (1885); English translation, *Memory* (1913).

corded by moving a bead from one end of a string to the other. A metronome was employed to control the regularity of repetition; and also to calculate the time required to accomplish the memorizing. The series thus learned was relearned after an interval. In this way the experimenter was able to determine the average length of time and number of repetitions required to memorize series of varying length, and also the average length of time and number of repetitions required to relearn the same series after variable intervals during which the series had not been recalled. The results showed that, although the learner might be quite unable to recognize a repeated series as having previously been memorized, there is a saving in the time and in the number of repetitions of the second over the first learning.

On the basis of these results Ebbinghaus was able to plot a curve of forgetting which indicates that the impression fades very rapidly during the first hour following the initial memorization; thenceforth it fades more slowly, yet so slowly that even after a month's interval a series of twelve or thirteen syllables is relearned with a saving of some twenty per cent over the first learning (see Fig. 6).

Experiments of this kind have been repeated and extended by many investigators, with the result that a doctrine of the mechanics of memorization has been laid down which has gained a widespread adherence. Unfortunately, the presuppositions of Ebbinghaus and his successors were of a sort to bias both the work done and the inferences drawn from it. These presuppositions were those of the "associa-

tionism," already criticized, and of the "pathway theory" of nervous action which had become the accepted explanation of association. No one then doubted that the memorizing of any group of ideas or objects must depend upon a distinct impression of each separate idea or object. These distinct impressions, together with whatever else might be experienced at the time, were supposed to constitute an associated nexus which could always be reduced by analysis to a kind of mosaic of separate parts or entities. Even

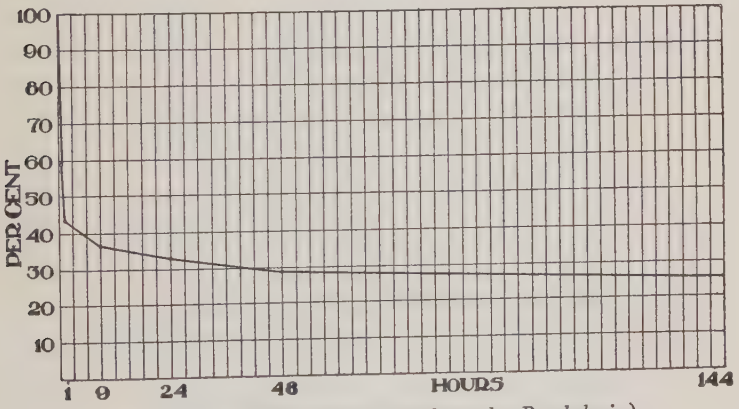


FIG. 6. (From Ebbinghaus's *Grundzüge der Psychologie.*)

the ingenious use of nonsense syllables was prompted by the demand for a material in the shape of separate impressions, similar to the verbal forms so commonly employed in everyday life, yet shorn of the associative connotations that words usually possess. The conjoint impression of these separate parts was supposed to be made by sheer contiguity in space and time. If one thing was associated with another whenever the two happened to be together, the

repetition of the two was supposed to be the most important means of establishing a clearly defined pathway from one impression to another in the nervous system.

More recent work upon memory under different conditions has shown that the mechanics of memorizing, which the earlier experiments had seemed to demonstrate, was artificially injected into the results by the method employed. Memorizing is an activity involving a dynamic configuration of behavior. The "meaninglessness" of a series of nonsense syllables is only relative. Although these syllables are unrepresentative, and possess fewer membership characteristics than words or commonly employed prefixes and suffixes, they can and do enter into a variety of configurations of order and rhythm, in appearance, utterance, and sound. Indeed, it is only when the series becomes a unified whole, with a certain pictorial composition, with a specific articulatory progression, or with beat, measure, and melody, that the series can be memorized at all. "Associations" between the members of a pair of syllables are determined by the membership of the pair: for instance, a trochaic measure, or a pictorial effect of symmetry, like that of *p* and *d* in *mip del.* Unless a pattern is formed which suggests its own completion, the first syllable of a pair will *not* recall the second, even after the two have been repeated together hundreds of times. What is remembered is always a configuration, the members of which hold together precisely for the reason that they are members of a configuration.

When one putative member inhibits another in recall, it is because the two inhibiting members belong to a configuration which is not well enough defined to cause the two to fall into their proper places. Hesitation in the performance of a habit will sometimes occur because of the reciprocal interference of members, each of which belongs to the habit, but not at the same time. This fact is illustrated in a well-known test of canceling certain letters on a printed page. If the letter be *a*, practice will improve the rapidity and accuracy with which the task is achieved. If, after such practice, the observer is instructed to cancel *e*'s, his results may be poorer than they were the first time he canceled *a*'s. Although the configuration of the two acts of canceling *a*'s and *e*'s is in many respects the same, the precise setting for *a*'s makes it impossible to overlook this letter in the new task of searching for *e*'s. Consequently, the observer must in effect do two things: avoid *a*'s and cancel *e*'s; and this proves to be more difficult than canceling *a*'s without practice.

Another illustration will show the effect of setting, or context, upon habit. Ordinarily I carry my watch in a pocket on the right side of my vest. In dress-clothes, however, I carry it on the left side. This change does not confuse me so long as I am in the situation of being dressed for a formal occasion. If, however, I relax into a situation of everyday life—after the party is over, or in intimate conversation with close friends—I may find myself vainly fumbling for my watch in the right-side pocket.

§ 48. *Memory and Imagination*

A motive leading to a revival can supplement itself in one of two ways: (1) by reproducing a phenomenal configuration of the past, which we call *memory* or remembrance; and (2) by producing a new configuration, which we call *imagination*. A memory is a figure on a ground, or in a context, that serves to place and date it with a certain degree of accuracy as something previously experienced. The accuracy of this placing and dating is variable, and depends upon both the intrinsic structure of the figure and the nature of its ground or context. Thus, as we have seen in the experience of *déjà vu*, familiarity may be very vague as regards figure, yet very insistent as regards ground.

The image of imagination, on the other hand, is a configuration, the internal structure and context of which do not place and date it as having been previously enjoyed; instead, the figure is new, never before experienced. Our study of membership-character has taught us that this distinction of memory and imagination is one of function rather than of quality, and that we sometimes recognize a new experience, perceptual or imaginary, and sometimes fail to recognize an old one. Functionally, it is a matter of indifference whether the contents are new or old, imaginal or perceptual. The question is whether the experience as a whole conforms to normal ways. We build up these ways and learn to recognize them as normal procedures, in contrast with the somewhat divergent ways of the new

and the untried. Thus we acquire two categories of experience, of the old and tried and of the new and untried. With the aid of these categories we survey and pass judgment upon whatever happens.

While imagination signifies new and untried constructions and reconstructions of revived experiences, it is functionally in no wise different from the inventions and discoveries of perception. Indeed, a line can seldom be drawn between the two with any degree of sharpness, because the creative imagination of artist and poet is constantly aided by the registration of colors and words, whereas the inventor of new devices works not only with his graphs and models but also with his imagination.

An acute description of the mental operations of a "perceptive," as opposed to a rationalizing, mind is given by George Meredith in *The Egoist:*

> De Craye strolled through the garden. He was a gentleman of those actively perceptive wits which, if ever they reflect, do so by hops and jumps: upon some dancing mirror within, we may fancy. He penetrated a plot in a flash, and in a flash he formed one; but in both cases, it was after long hovering and not over-eager deliberation, by the patient exercise of his quick perceptives. The fact that Crossjay was considered to have Miss Middleton on the brain, threw a series of images of everything relating to Crossjay for the last forty hours into relief before him; and as he did not in the slightest degree speculate on any one of them, but merely shifted and surveyed them, the falcon that he was in spirit as well as in his handsome face leisurely allowed his instinct to direct him where to strike. A reflective disposition has this danger in action, that it commonly

precipitates conjecture for the purpose of working upon probabilities with the methods and in the tracks to which it is accustomed: and to conjecture rashly is to play into the puzzles of the maze. He who can watch, circling above it a while, quietly viewing, and collecting in his eye, gathers matter that makes the secret thing discourse to the brain by weight and balance; he will get either the right clue or none; more frequently none; but he will escape the entanglement of his own cleverness, he will always be nearer to the enigma than the guesser or the calculator, and he will retain a breadth of vision forfeited by them. He must, however, to have his chance of success, be acutely besides calmly perceptive, a reader of features, audacious at the proper moment.[1]

Such a combination of perception and reflection, in which a "secret thing" is allowed to "discourse to the brain by weight and balance," gives us the key to creative imagination, whether it be that of poet and inventor, or merely the sharp intuitions of everyday life.

§ 49. *Imaginal Type-Distinctions*

It is sometimes supposed that the quality of imagery enjoyed by an individual will determine the nature of his mental operations, and furnish an insight into his type of mind. The pedagogical implications of this view suggest a proper training of the mind in order that appropriate imagery may be at the disposal of an individual in his processes of thinking. When a person's imagery is analyzed with reference to sense-modality, it may be found that he favors visual, or auditory, or kinæsthetic qualities in representing to himself his perceptual experience of objects,

[1] Author's edition (Boston, 1894), pp. 419 f.

words, gestures, etc. These different kinds of imagery seem to function differently. Visual imagery, for instance, is more or less expansive and static, whereas auditory and kinæsthetic imagery are sequential and dynamic.

The French psychologist Alfred Binet once investigated the mental operations of two famous "lightning calculators," and found that one of them seemed to be visually minded whereas the other was inclined to employ auditory imagery in his calculations. Binet was able to show a striking difference in the methods of these two calculators by an ingenious test in which he presented to each a square of five-place numbers, instructed them to remember it, and afterwards asked for certain digits of the square—for instance, those of the right-to-left diagonals (see Fig. 7). He found that both calculators were able to recall the digits correctly in any order; but if the order called for was not the natural order of the digits by lines from left to right, one of them would invariably perform the task much more quickly than the other. From this difference in time, as well as from other differences in their performances, Binet concluded that the one of them, being visually minded, was able to read off the required digits from his mental image as though they were written down on a tablet, whereas the other, whose imagery was auditory rather than visual, was slower in performing the task because he was forced to repeat the numbers over in their given order

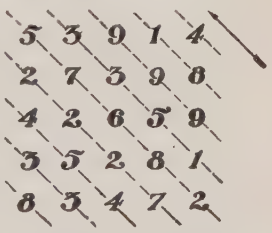


FIG. 7. (After Binet.)

until he arrived at the required digits.[1] Although instances of this kind are exceptional, there can be no doubt that habits of mind often involve the employment of imagery of a certain quality.

The pedagogical implications which have sometimes been drawn from this distinction are, however, untenable. Even though it be true that mental operation upon visual imagery is more rapid than it is upon auditory and kinæsthetic imagery, we know no means of improving the quality and precision of imagery in and for itself.[2] Mere practice in imaginal representation of a certain modality does not appear to increase the frequency or improve the vividness of the images; neither does a readiness to perceive in a particular sense-modality guarantee an equal readiness to revive images in that modality. An individual who is unusually observant of what he sees may be entirely bereft of any capacity to revive a seen object as a visual image. Such imagery as he can control may be altogether verbal and gestural.

In order to understand habits of mind we must take into account the favoring of perceptual as well as imaginal qualities; and of the two, perceptual types of mind are more original and vastly more important than imaginal types. Furthermore, a true type of mind is distinguished by the configurations it seeks and employs; and these can

[1] Cf. *Psychologie des grands calculateurs et joueurs d'échecs* (1894), pp. 143 f.

[2] Cf. W. S. Foster, "The Effect of Practice upon Visualizing, and upon the Reproduction of Visual Impressions," *Journal of Educational Psychology*, 1911, *2*, pp. 11 f.

never be adequately described in terms of sense-modality. The nature of a figure is revealed by its rhythm, proportion, balance, symmetry, articulateness, and contour. Sensory quality is significant only in so far as it aids or hinders the formation of a figure. Binet's two "lightning calculators," operating without a great show of intelligence upon numbers which they remembered in imaginal forms, were nevertheless operating with the forms these numbers assumed, and not with a mere accretion of imaginal data. Another calculator, who was also a highly intelligent mathematician, investigated by the German psychologist G. E. Müller,[1] was able to perform much more remarkable feats than Binet's pair of professional entertainers. The formal aspect of the mental operations in Müller's subject was intricate, and far more significant than a mere ability to register and retain the images of numbers would account for. Indeed, different minds achieve the same results by the employment of means which, when subjected to analysis as sensory qualities, are found to be widely divergent. The important thing is always the figure; how this shall be clothed, sensorially and imaginally, is more or less a matter of taste in the selection of draperies which happen to be available. We are therefore unable to conclude that a special training of imagery for itself can be of any great pedagogical significance. On the contrary, imagery is a secondary feature, depending upon the forms of perception and reflection

[1] Cf. "Zur Analyse der Gedächtnistätigkeit und des Vorstellungsverlaufs," *Zeitschrift für Psychologie*, Erg.-Band 5, 1911.

which an individual employs.[1] What, as teachers, we must look after is a correct apprehension and response, the criteria of which are not abstract qualities of imagery, but forms of behavior.

§ 50. *Methods of Memorizing*

Good methods of memorizing will accord with the previously stated laws of perseveration and association.

I. Since first impressions are lasting, it is highly important that the initial apprehension and response should be accurate. When the configuration to be remembered is simple and precise, a lasting memory of it may be achieved in a single stroke. The discovery that $2 \times 2 = 2 + 2$, that red and yellow make orange, or that certain qualities are in paired opposition, may, under favorable conditions, be comprehended and remembered always. In other cases, the initial form of the configuration is of necessity incomplete in its membership, and the progress of study consists in filling gaps and integrating a whole which, at first, was only loosely articulated. The important thing then is to make the first presentation of a new subject adequate to the development that must ensue. In a positive sense this means that we should present at first only such forms as the learner can grasp and remember; and in a negative sense, that we should avoid all possibility of making inappropriate impressions on the memory which must later

[1] Cf. the writer's article entitled "Some Experiments on the Consciousness of Meaning," *Studies in Psychology contributed by Colleagues and former Students of Edward Bradford Titchener* (1917), pp. 79 f.

be unlearned or dissociated. A good teacher will draw the lines of a new subject so skillfully that an engaging pattern will be formed in the mind of the pupil by the first presentation. Often this pattern will be very general in scope. In some cases it might take the form of a survey of the whole field of the study about to be entered upon. In other cases, however, a general survey might be unwise, because it could only mean to the pupil an orientation so vague as to be either useless or misleading. In order to be effective, the beginning of a subject must be definite: some simple problem, the scope of which can be clearly compassed, leading to a solution equally clear and unambiguous. It should be the object of the teacher to present a problem which stimulates the pupil's curiosity, and at the same time avoids confusing him with fortuitous and misleading details. In other words, first impressions on the memory should be those of figures which are potentially "good," and which will arouse a definite want for their fulfillment.

II. Since a good memory depends upon the perseveration of the figure to be remembered, a certain time must be allowed for the process to "set" after the impression has been made. If one configuration is immediately superseded by another and quite different configuration, the consolidation of the first will be interfered with, and it may vanish altogether from memory. Sometimes *retroactive amnesia* results from this interference. When one is suddenly and unexpectedly interrupted in an undertaking by a shock of any kind, the events which immediately preceded the

shock may be irretrievably lost to memory. This is particularly true when an accident renders one unconscious. One is quite unable to recall what happened, or how the accident came about. The loss of memory may extend backwards over a period of only seconds or minutes; but the disruptive effect can also entail a *retrograde amnesia* which, in an extreme instance, may involve the whole of one's past life. Cases have been reported in which, after recovery from a shock involving a state of coma, the entire memory was a blank, the individual being unable to remember or recognize even his own name. Yet retroactive and retrograde amnesia are not merely different degrees of the same kind of forgetfulness; for retroactive amnesia is absolute, and applies only to the configurative processes going on at the time of interference, whereas retrograde amnesia is a more or less profound dissociation of the memorial residua. That the residua themselves are not obliterated is shown by the results of re-education, which gradually restores to the individual the control over his past life which he has temporarily lost. Re-education, which consists in piecing together the dissociated fragments of the past, may be difficult, and in certain pathological cases, impossible; but the success sometimes achieved by it shows us that retrograde amnesia is a disorganization and disintegration rather than a complete loss of the residua of past experience.

In the case of a minor disturbance, like distraction, the memory of the events or subjects upon which the mind has just been at work simply loses its sharp contours. One

of the baneful effects of "cramming" for examinations is attributable to this cause. While a rapid review of a well-articulated material can be highly beneficial, both as a preparation for examination and also for a lasting memory of the subject, this will not be the case when the material is crammed in semi-detached fragments. Particularly when one passes quickly from one subject to another and unrelated subject, the effect of retroactive amnesia is sure to be felt in the interference which the second subject exerts upon the first. It is therefore a good rule to pause after completing one subject, and allow the mind "lie fallow" for a minute or two before taking up a new and different subject. Such a pause will permit the processes involved in the first subject to persevere and consolidate themselves, before a new process is started.

III. Successive repetition of a subject will promote memorization only when the conditions of repetition favor the definition of the contours and the inner articulation of the figure being memorized. While mere repetition is of no avail, it is impossible to do anything again and again without falling into some sort of rhythm, without giving heed to balance and proportion—without, in short, emphasizing formal features of behavior which aid the memory. This service of repetition is especially helpful in sequential events, and, as we have seen, is a prime requisite in the acquisition of skill (cf. § 36). That repetition is merely a condition for the formation and consolidation of a "good" figure, which is remembered because it is good, has been shown by

the fact that the repetitions are more effective when they are distributed in time than when they are undertaken in close succession. One can commit a series of nonsense syllables to memory with fewer repetitions and with more lasting results if one distributes the repetitions over several days than if one commits the series to memory at one sitting. Jost, who investigated this matter, employed series of twelve nonsense syllables, each of which he repeated twenty-four times. Upon relearning, he found best remembered those series which he repeated but twice a day over a period of twelve days; next best, the series he repeated four times a day for six days; and least well-remembered, the series he repeated eight times a day for three days.[1] These results doubtless involve the effects of primacy and perseveration described under previous headings; but they also show that in order to be most effective repetition must serve to consolidate and define the figure that is being memorized.

IV. As regards the figure itself, it is better to take it as a whole than piecemeal. Thus the members of a single series, whether the series be long or short, will become more closely knit together in memory if the whole of the series is viewed or reviewed at one sitting. In committing to memory a long narrative, or a speech, one is apt to be appalled by the task, and therefore inclined to break the

[1] Cf. Adolf Jost, "Die Assoziationsfestigkeit in ihrer Abhängigkeit von der Verteilung der Wiederholungen, *Zeitschrift für Psychologie und Sinnesphysiologie*, 1897, *14*, pp. 436 f.

material up into parts and attempt to commit them separately to memory. This procedure, however, is less efficient than the more direct one of reading the whole piece through at one sitting and then repeating the process once daily until the material is mastered.

It is true that the method of repeating the whole piece from beginning to end at one sitting is sometimes inapplicable. For instance, it may be impossible for a child to give the necessary heed to a task involving, say, memorizing a poem of a dozen stanzas; whereas the same child could learn the poem by taking one stanza at a time. This exception, however, only proves the rule that in order to be remembered a configuration must be grasped as a whole. The capacity to grasp a series of words, syllables, numbers, tones, actions, etc., as a whole will vary with age and with individual propensity. The rule states only that within the capacity of the learner it is better to memorize by wholes than by parts. Whenever we memorize something by parts, and then fit these parts together into a whole, the integration is always weaker than it would have been if we had memorized the piece as a whole. So far as the practice of setting children tasks of memorizing is concerned, it is far better that they be not required to remember pieces longer than they can master by complete repetition. While the subsequent integration of parts into larger wholes is a very important aspect of learning, as we shall see when we take up that subject, memorizing the parts of a predetermined whole, which as parts are not themselves com-

plete wholes, is a pedagogically false and unwarranted procedure. For educational purposes, no child, or indeed any other person, should be required to memorize anything which he can not readily and heedfully repeat entire at one sitting.

§ 51. *Observation and Report*

In every study a pupil is required to observe facts, or the verbal, numerical, and other expressions of facts; and our criteria of the knowledge which he acquires of these facts is contained in his report upon them. Reports may be oral, written, drawn and diagrammed, or acted. The ability of an individual to make an exact and truthful report depends upon the nature of the material observed, the conditions under which the observation was made, and also upon technical skill in reporting, all of which vary with the age and development of the observer. An infant will observe a thing, together with its dynamics, its qualities, and the "togetherness" of its members, as a single act of behavior. The report of the observation, whenever a report can be elicited, will contain these various features without discrimination. When a child designates a thing by naming it, this does not mean that he merely attaches a label to the thing, and overlooks its function, its quality, and its relation with other things. On the contrary, the first words of childhood are "sentence-words," which express whatever the object signifies (see the discussion of *naming* in § 64). The differentiation of varied meanings is observable in the total-attitude of the child; and the subsequent

development of the child's vocabulary goes hand in hand with the differentiation which the child makes in his observations and responses.

Out of the matrix of the "sentence-word," which chiefly designates a thing or an event, the first differentiable aspect appears to be the dynamic one that *things do things*, action being now separately observed and reported upon. For instance, a dog, which at first is all things that a dog may be within the limited experience of a child, now appears as a dog running, or a dog lying down, or a dog wagging its tail. A second aspect of observation which can be discriminated and separately reported is the *quality* of the object. The dog which runs, or lies down, or wags its tail, is also a brown or a black dog, a large or a small dog, a quiet or a barking dog. Third, and lastly, the particular thing defines its relation with other things. The dog runs after a stick, or it lies down upon a rug, or it wags its tail when it sees some meat.

According to Stern,[1] these differentiations indicate three genetic stages in the development of a child's powers of observation and report. The first he calls the *substance-stage*, the second the *action-stage*, and the third the stage of *relations* and *attributes*. We have suggested two corrections to this view: 1) Instead of regarding these stages of development as successive and cumulative, we must doubt a necessary order in time, and a successive enrichment of content by the mere addition of something new.

[1] Cf. William Stern, *Psychology of Early Childhood* (1924), pp. 377 f.

The original datum of the "substance-stage" appears to include at once all the differentiable material that is later designated separately. Thus, a designation of the dynamic aspect would not necessarily precede a designation of the attributes of the object, or its relation to some other object. 2) Our second correction distinguishes *relations* and *attributes;* since the former obviously belong to a configuration of "togetherness," whereas the latter are what we have chosen to call the qualitative aspects of a thing-pattern. [1]

It should also be remarked that what Stern calls the substantive- or thing-stage is not the beginning of observation, but the cumulative effect of differentiating objects and their properties from their dynamics and their relations with other objects. While the substance of a thing is implicit from the outset, substance is defined only after the configuration establishes a contour by becoming detached from its surroundings. All observation takes this general course of definition. The internal structure of the data observed determines the contours of separate things, together with their attributes and dynamics. These separate things are then related to one another, by virtue of their membership in a larger whole.

It is a well-known fact that individuals vary greatly in their capacity to make accurate observations and to report what they have observed. An important part of any educational procedure consists in training observation and report. The pedagogical principle involved in this training is that

[1] Cf. Koffka, *op. cit.*, pp. 298 f.

of configuration, which has already been discussed at length. Faulty observation and imperfect report are alike attributable to incorrect and incomplete figures. The difficulty may be chiefly on the side of observation, or of report, or of both together.

On the side of observation there are a number of specific errors which can be guarded against in presenting the material to the student.

1. In the first place, the level of observation, just described, is of great importance. A young child cannot distinguish clearly the properties of a thing, or the bearing of one thing upon another. The action taking place may or may not be specially noted as the action of a clearly defined object; because action, itself, may be so prepotent that the impression of activity is greater than the impression of that which is acting. These various aspects of the configuration are observable, even though we cannot assign to them a definite order of development, as Stern does. In a somewhat different way these same characteristics of observation function in adults. Something happens suddenly and unexpectedly, and we have no definite impression of what it was, although the course and direction of the event was quite definite. So, too, we can observe definite relations in space and time—for instance, one thing to the right of another, or one thing after another—without observing what these things were. Attributes, such as color, tonal quality, intensity, softness, and uniqueness, often impress us more firmly than does the substance that pos-

sesses them. In all these ways configurations are formed, the structure of which is incomplete.

2. The completion of a defective configuration by rational or other means is a second important source of error in observation. Whenever an observation is incomplete, a native urge for completion leads to a supplementation of the missing parts or members. In this completion we have recourse (a) to the rationalized forms of conventional thought, which will piece out a defective figure even while it is being observed; and also (b) to the free play of imagination, which will gloss over any defects that are felt. One may *see* the water in a bird bath with eidetic veridity, even though the water has been drained off.

3. A third error of observation, closely allied to those just mentioned, is oversight. Important details and even clearly presented figures are often overlooked. The pattern of the whole observation is then drawn without including certain features of the observed material. Errors of omission will always be found when there is a large number of detached and unrelated objects. A familiar parlor-game will serve to illustrate. A large number of miscellaneous objects are placed on a table under cover. Upon signal, the cover is removed for a short time, and the company is instructed to observe; the cover is then replaced, and the observers are asked to make a list of as many objects as can be remembered. A test of this kind can easily be rendered so difficult that no one can master it.

4. A fourth important source of error in observation is the fixation of a mistake in accordance with the laws of primacy and repetition. First impressions are lasting; and if the material observed is molded to fit a conventional form, or suffers accretions of imagination, or restrictions of oversight, these falsifications are likely to become a permanent adjunct of the remembered pattern. Upon repetition, these falsifications harden in their setting; and although, at first, they may have been less insistent than the members actually observed, we come finally to accept them as readily as we do the actually observed data of the original experience. Thus, in repeating a story based upon fact, not only do we alter the details so as to make the story-pattern more effective, but we come to believe as firmly in the fiction with which we have dressed the story, as we do in the facts upon which it was founded.

On the side of report there is also an elaborate technique involved in telling "the truth, the whole truth, and nothing but the truth." Some years ago, in his seminary of legal students at the University of Berlin, Professor von Liszt, the well-known criminologist, performed what has become a classical experiment on testimony. To paraphrase Professor Münsterberg's account:

After Professor Liszt had spoken about a certain book, one of the older students suddenly shouts: "I wish to throw light on the matter from the standpoint of Christian morality!" A second student shouts: "I can not stand that!" The first leaps up, exclaiming: "You have insulted me!" The second

clenches his fist and cries: "If you say another word—" The first whips out a revolver. The second rushes madly upon him. The Professor steps between them, and as he grasps the man's arm the revolver is discharged. General uproar. As soon as Professor Liszt secures order, he asks a part of the students to write down an exact account of all that happened. The episode, of course, had been carefully planned and rehearsed by the three actors for the purpose of studying the exactitude of observation and recollection. A part of those who were not asked to write a report at once were asked to write it the next day, or a week later; and others were called upon to depose their observations under cross-examination. The whole performance was divided into fourteen units which referred partly to actions, partly to words. Reckoned as mistakes were the omissions, the wrong additions, and the alterations. The smallest per cent of errors was twenty-six, the largest eighty. The reports of the second half of the performance, which was more strongly emotional, contained on an average fifteen per cent more mistakes than those of the first half. Words were put into the mouths of men who had been silent spectators; actions were attributed to the chief participants of which not the slightest trace existed; and essential parts of the tragi-comedy were completely eliminated from the memory of a number of witnesses.[1]

Professor Liszt took this means to bring home to his students the fallacious quality apt to appear in certain forms of legal testimony. The testimony of a witness upon an event for which he was quite unprepared is untrustworthy, not only on account of many errors of omission, but more especially—and it may be disastrously—on account of errors of commission in reporting events and details, often of material importance, which did not happen at all.

[1] Hugo Münsterberg, *On the Witness Stand* (1908), pp. 49 f.

The chief source of error in report is attributable to the *suggestibility* of the witness. By suggestion we mean a susceptibility to the guidance of impersonal data. Instead of reporting on the ground of one's own impressions, one follows whatever lead may be given by the persons or things that surround him. A skillful lawyer will often make use of this human frailty in order to confuse a witness and invalidate his testimony. Even more, it is sometimes possible by this means to elicit testimony which is entirely false.

In the schoolroom the baneful effects of suggestion are constantly felt. Most children are suggestible, some more so than others; but the atmosphere of the schoolroom may be such that suggestion becomes the chief method employed even by those pupils who are not highly suggestible. The process of education then becomes a game of reading the teacher's mind, and giving back in recitation or in written work "what the teacher wants." Instead of studying a subject for its own sake, and mastering it in one's own way, the student defers to the teacher's wisdom, taking every cue from the teacher and his way of putting the matter, or from the text-book which the teacher commends.

Report elicited by questioning is particularly susceptible to guidance of this sort. It is hard to frame a question that does not suggest an answer; and "leading questions," as they are called, are peculiarly subversive of true education. At the other extreme are the questions which require an answer of "yes" or "no." Yet here the chances

are even, so that the score of right answers is not likely to fall very low if one has no knowledge at all of the subject.

For the purpose of eliciting a student's knowledge of facts the method of "narration" is to be commended. Allow the student to tell what he knows about a given subject, and his faults will more likely be his own than those suggested at the moment by the way the question is put. Why, then, is not the method of narration more frequently employed in the examination of students? One reason, perhaps, will be found in the bad training most students have had under the suggestive influence of many years of schooling. For without good training, students will often respond in the discussion of a topic with wide-ranging, ill-formulated irrelevancies. But the test is no less a good one for this reason; because the failure of a student to narrate succinctly and clearly is the truest indication of his faulty knowledge of the subject. If questions could be banned from all examinations in all grades, we should, in time, be forced to devise methods of teaching on a saner and more effective plan. When a student can be made to realize that education is *his* business, as well as the business of his teacher, he will become more intent upon observing the facts placed before him, and upon formulating knowledge in accordance with the facts themselves, rather than in accordance with what the teacher says, or what the author of his text-book states. It is related of an old-time college teacher that he always conducted his recitations by referring to the text-book with the

question, "And what does the author state next, Mr. ——?" No wonder that education is artificial, and study a bore, if it is to consist in remembering and reporting upon what other people have thought and written!

The degree of conviction on the part of the observer has much to do with the accuracy and reliability of his testimony. It is for this reason that in legal procedures an oath is required of witnesses. Lesser degrees of assurance have been differentiated in an ascending series as follows: a) neither affirmation nor denial; b) admission that a thing or event may be true; c) a belief that it is true; and d) an assurance that it is true. The effect of an oath, or the willingness to swear to the truth of a thing, depends, of course, upon the significance of a solemn obligation to "speak before God." But these degrees of assurance are rarely if ever clear-cut distinctions. So far as pedagogy is concerned, the point is to secure a report which comes from the observer's own knowledge of the subject, and which has the sanction of his willingness to tell what he knows, and to be unafraid to admit what he does not know.

§ 52. *The Law of Precision*

It is obvious to all that impressions and responses are not observed, remembered, and reported with equal facility. A "good" configuration always has an advantage over a "poor" one, the degree of "goodness" depending upon the intrinsic character of the figure as well as the nature of the ground from which it emerges. As to the figure itself, the

organism is qualified by nature to apprehend and respond in certain ways better than in others. These natural modes of apprehension and response constitute *favored forms*, psychophysically determined, which serve as *norms* of perception toward which variant forms converge. These natural types are characterized by a simplicity and a stability which other forms lack. A circular form, for instance, is somehow simpler and more stable than a square, which, in turn, is simpler and more stable than a triangle. The equidistant spread of tension gives rise to circular forms in many physical objects. For instance, if a loop of string is lightly placed upon the surface of a soap film stretched on a wire frame, and the film within the loop is carefully pricked, the tension of the film is such that the loop will immediately assume the form of a circle.[1] Similarly, if a continuous loop of flexible wire is charged with electricity, the internal tension will cause it to assume the circular shape of a hoop. In the distribution of light over the retina of the eye, equal distribution from a center is favored, giving an optical counterpart of the circle which we so readily apprehend. It has often been noted that if one observes the visual after-image of a square figure as it begins to fade from view, the corners of the square will be first to disappear, so that the vague impression assumes a circular form. The prepotency of the circle is apparent in any vaguely defined figure of sight, the edges of which seem not only blurred, but rounded. Leonardo

[1] Cf. Sir William Bragg, *Concerning the Nature of Things* (1925), pp. 99 f.

da Vinci, who was an observer of remarkable acuity, states in one of his Note-Books:

> In every figure placed at a great distance you lose first the knowledge of its most minute parts and preserve to the last that of the larger parts, losing, however, the perception of all their extremities, and they become oval or spherical in shape, and their boundaries are indistinct.[1]

The gratifying effect of curves, as opposed to straight lines and angles, is well known in all forms of pictorial art. One thinks particularly of the "refinements" of Greek architecture; that is, of the avoidance of perfectly straight lines in the columns, eaves, stylobate, and entablature of a Greek temple. Again, when one sees a light shining through a fog the impression is that of a circular form, although it is impossible to determine the limits of radiation. Many other illustrations might be cited to indicate the prevalence of certain forms, both in the physical and in the psychological world; for circularity is but one instance of simplicity and stability; other forms meet other conditions just as naturally and inevitably.

As regards memory, all observed data undergo change in the direction of more stabilized norms. The details first to disappear in forgetfulness are the more or less irrelevant addenda to the configuration; but even the figure itself suffers change unless it is already of a definite type, as the circle is by nature, and as many other forms are by ac-

[1] MS G 53, Bibliothèque Nationale. Cf. E. McCurdy, *Leonardo da Vinci's Note-Books* (1913), p. 219.

quisition. These changes are most noticeable in equivocal figures, the stability of which is not guaranteed either by a natural psychophysical propensity to retain them as they are, or by an acquired definition such as attaches to well-known objects and things, like dogs, chairs, persons, and names. Successive reports upon the same figure, provided it be in any way equivocal, will reveal a constant change in the direction of some outstanding feature or accent. What is emphatic in the figure becomes more so; what is not emphatic becomes less so. Thus repetition reduces the figure to a more precise form.

The following illustration, taken from the experiments of Friedrich Wulf,[1] will indicate some of the changes which took place in the recollection of previously perceived drawings (see Fig. 8). In each case the successive reproductions from memory show a constant variation in a certain direction. In the first instance we have straightening and lengthening of the longer line; in the second, the approach and attainment of right angles; and in the third, a less obtuse angle, together with a lengthening of one shank accompanied by a shortening of the other. These changes, either in the direction of emphasis of a certain characteristic, or in the direction of a leveling down or understatement of some feature of the figure, are all in the interest of a better, simpler, more normal configuration. Emphasis may attach to some members of the figure, while under-emphasis affects

[1] "Beiträge zur Psychologie der Gestalt, VI: Über die Veränderung von Vorstellungen (Gedächtnis und Gestalt)," *Psychologische Forschung*, 1922, *1*, pp. 333 f.

others; or the entire figure may either emphasize or reduce its outstanding feature so as to become larger or smaller, more pointed or less pointed, more curved or less curved, etc. This change, which takes place regularly, both in perception and in the residua of memory, as "a tendency on the part of every configuration to become more simple and precise,"[1] may be called the *law of precision.*

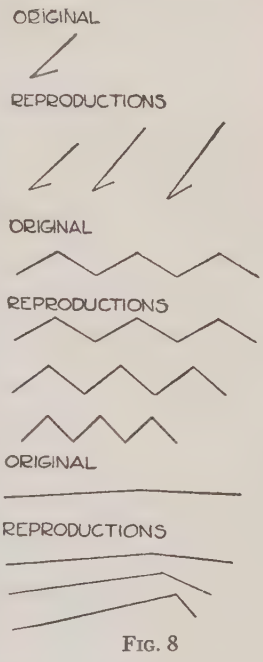


FIG. 8

Not only do perceived objects and the residua of memory undergo these alterations, but also dynamic configurations in the apprehension of movement, and in the responses of bodily adjustment. On the physiological side, the condition of the organism called *tonus* is a general state of readiness for response, which serves as a "ground" from which the so-called *phasic* pattern of the specific behavior arises. This behavior-pattern follows the same law of precision, and varies in the directions of over- and under-emphasis according to the conditions of re-arousal, just as does the reproduction of visual figures in memory. Sherrington has described the "tonic" and "phasic" reflexes of certain animals in which the spinal cord had been severed from the

[1] Wolfgang Köhler, *Die physischen Gestalten in Ruhe und im stationären Zustand* (1920), p. 259. The German term for *precision* is *Prägnanz.*

cortex.[1] It appears, therefore, that the law of precision has a very general application to all forms of organic behavior; and instead of supposing that the residua of experience are retained as habits of definite and fixed structure, we can regard only the form as being set; for this alone will account for the fact that subsequent expressions of behavior and recollection constantly vary in the direction of greater simplicity, stability, and precision.

[1] Cf. C. S. Sherrington, *The Integrative Action of the Nervous System* (1906), pp. 302 f.

CHAPTER XIV

THE PROCESS OF LEARNING

§ 53. *Particularization*

We have already described certain aspects of learning in discussing the acquisition of skill (§ 36). An acquisition of skilled behavior is always the result of an act of perception. No golf-player can improve his score steadily without giving heed to what he is about; neither can a tight-rope walker retain his balance without being alert to his situation. In both these instances the configuration of the entire act must be heeded; an over-emphasis of any part-movement, or of any discrete objective which may emerge in the course of the act, would be disastrous to the performance as a whole.

This last statement may perhaps seem questionable; for does not the golf-player keep his eye on the ball, and does not the rope-walker fix his gaze upon the goal? It is of course true that a steady focusing of the eyes may be an important detail in both these acts of skill; but not in the sense of a discrete and independent perception of the objective or goal, because an expert rope-walker can do his trick blindfolded, and an expert golf-player can learn to drive his ball with speed and accuracy, even with his eyes closed. The dominance of vision in both these acts is more apparent than real. A steady fixation is necessary when the eyes are

open, because if the eyes wandered, the variable impressions of vision would be sure to interfere with the integration of the skilled act. Therefore we fixate what we can, under the circumstances, both for guidance and also in order to avoid interference. The beginner at golf finds it unreasonable that he should keep his eye on the ball instead of on the green towards which the ball is to be driven. He soon learns, however, that the perceptual dominance of his stroke resides in the configuration of the act, and not in the discrete objective which the act is expected to attain.

Unlike the perception of a complete act, the perception of a discrete objective is an abstraction. The objective of an act of behavior is at first implicit, but under appropriate conditions it becomes explicit. This change always does violence to the structure of the movement from which the objective emerges. Despite the genetic identity of the explicit form of the objective and its original implicit membership in the behavior, a transformation has taken place in which not only is a new context given to the objective, but the objective itself is altered. We shall refer to this process of alteration and transformation in behavior as the *particularization of an objective.*

When a skilled act is analyzed into its several members, the circuit of the act is utterly destroyed, and in its place each member emerges as a new creation. An attitude of active participation is superseded by an attitude of passive contemplation. This development has two phases. 1. As an abstract part torn from its natural context of behavior,

the newly created objective, being out of keeping with its context, is æsthetically unsatisfactory; hence, the awkwardness of movements when one gives special heed to them; or the complete cessation of movement when one becomes too intent upon some particular thing. Even at the instinctive level of behavior we meet with this over-emphasis of the objective in the fear which paralyzes action and leaves one rooted to the spot. 2. But particularization also accounts for units of experience that are enjoyable in contemplation.

Whether the effect of breaking up a skilled act is pleasant or unpleasant depends upon the conditions under which the behavior is analyzed. We have already described the ill effect of analyzing movements which depend for their completeness upon an inviolate rhythm. It is quite obvious that in giving special heed to a part-movement—that is, in particularizing it in abstraction from its context—we not only do violence to the smooth course of the movement as a whole, but create an action that possesses no intrinsic urgency to define itself. In order to employ such an act at all, we must give it an artificial setting; as we do, for instance, when with exercise we strengthen certain muscles by repeated innervation. Systematic exercise of this specific order is quite possible with man, and may have its beneficial effects; but how difficult and how artificial it can become is at once indicated when we attempt to train any other animal by this method. The tricks performed by circus animals are for the most part of this order; the

awkwardness and artificiality of these tricks is too obvious to be questioned. Driven by fear of punishment or expectation of reward, the dumb performers are literally put through their acts by the keeper with little or none of that participation which characterizes enjoyment. Any educational method that relies mainly upon putting pupils through the act of learning is pedagogically unsound, and may have devastating consequences by reason of its inherent artificiality.

The particularization of a movement belonging to a larger course of action can be naturally effected only when it achieves an end which the original response achieved less well. As an original total-response is refined, portions of it become balanced and poised so that certain other features can focus themselves more precisely upon the business in hand. There need be no tearing away of a specialized act from its context; instead, the entire response can be so re-shaped that the specialized action will emerge more clearly as the dominant feature of the entire act.

But it is not alone the sense of movement that is involved in this development. An organism that can see and hear, taste and smell, will find *objectives* as well as movements in its experienced behavior. These objectives arise whenever any phase of the total-experience builds a self-contained pattern. Originally, experience as the counterpart of behavior is only a felt want moving onwards in a circuit which closes when the want is satisfied. The pattern of this circuit, based upon attraction and repulsion, is further

differentiated by the vague though decisive features that characterize instinct. For instance, an infusorian called *paramecium* manifests a selective differentiation in its behavior when it encounters an obstacle in its path.[1] At first it retreats, then it approaches the obstacle again, though with a slight turning of the body, which, after one or more trials, according to the size of the obstacle, finally enables it to move forward and clear the obstruction in its way. One cannot say that the *paramecium* at first perceives the object in its path, for if that were true it would at once gauge its forward movement so as to enable it to avoid the obstacle. Yet a succession of frustrated forward movements does have the effect of provoking slight turning movements which finally provide an effective means of escape. In other words, an objective can influence behavior even when it is not perceived as an objective. (See Fig. 9.)

In our previous example of a human being who stumbles over a stone in his path, we have a similar situation in which the objective influences behavior without at first being perceived as an objective. In each case something emerges in experience which, under more favorable conditions, might have been avoided. Since the *paramecium* is unable to profit by these more favorable conditions we may conclude that its capacity for learning is slight. All learning is perceiving. An instinctive response is patterned; and its pattern is capable of refinement. When refinement brings

[1] Cf. H. S. Jennings, *Behavior of the Lower Organisms* (1915), pp. 47 f.

the objective of behavior into focus, the process is one of perception, and at the same time one of learning. All learning depends in the first place upon *particularization*, or the emergence of a pattern of behavior possessing some degree of cohesion. At its lowest level, this pattern is the simple "all-or-none" type of response. At a higher level,

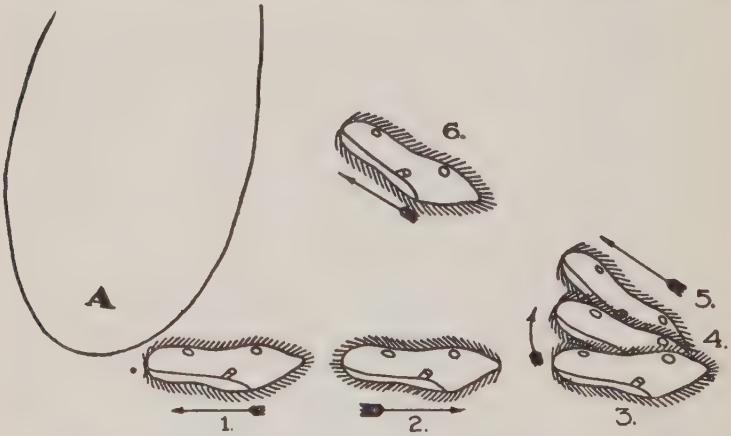


FIG. 9. Diagram of the avoiding reaction of Paramecium. *A* is a solid object or other source of stimulation. 1–6 are successive positions occupied by the animal. (From Jennings's *Behavior of Lower Organisms*.)

where there are different ways of perceiving, there are likewise different ways of learning. These ways can be classified under four general headings: 1) *differentiation*, 2) *assimilation*, 3) *gradation*, and 4) *re-definition*. Although all four ways are interrelated in the single process of perception, we shall consider them separately.

§ 54. *Differentiation*

The behavior of the *paramecium* in its encounter with an obstacle is an example of differentiation at a very low

level. Inability to perceive the obstacle leaves the organism in the same condition after its encounter as before; it does not seem to behave in any different manner in a subsequent experience. Traces of learning can, however, be found in lower organisms. An *amœba*, for instance, will readily eat a particle of carmine which possesses no food value. If hungry, it "will eat the same carmine grain several times in succession, but with each eating the grain

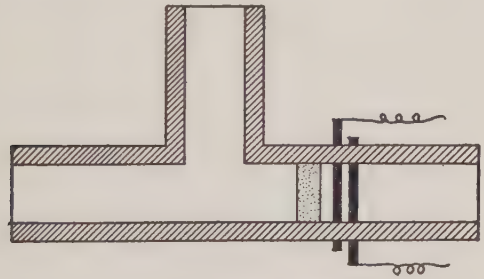


FIG. 10. (After Yerkes.)

becomes less attractive, until finally it is refused."[1] In the experiments from which the above conclusion was reached, learning to avoid the carmine grain took place in several *amœbas* after the organism had ingested and egested the same particle once, twice, or three times.

A more definite form of learning by differentiation can be illustrated by the behavior of the earthworm. Experiments have been performed with a narrow T-shaped maze into the stem of which the worm is introduced (see Fig. 10). After crawling forwards to the crossbar, it must choose

[1] Cf. A. A. Schaeffer, "On the Feeding Habits of Amœba," *Journal of Experimental Zoology*, 1916, *20*, pp. 574 f.

which way to turn. If it turns to the right it can proceed to its burrow; but if it turns to the left it encounters a bit of sand-paper, beyond which it comes upon a device that gives it a painful electric shock. After a number of trials, varying from 20 to 200, the worm learns to turn to the right. If the electrodes are then changed to the other arm, the same worm will learn in a reduced number of trials to turn to the left. Furthermore, after a certain turn has been learned, the removal of the brain, or supra-esophageal ganglion, does not destroy the habit.[1]

These experiments indicate a very low form of selective behavior, involving a total-set of the organism induced by the method of learning known as *trial and error*. In learning of this kind the entire animal participates to such an extent that the habit persists even, in the case of the earthworm, after decapitation. The forced nature of the worm's response, together with the doubtful psychology of the behavior involved, have led some investigators to regard learning of this simple type as entirely a physical affair. It has also been held that learning of this kind is the prototype of higher learning; and, consequently, that an understanding of the physicochemical changes which accompany the worm's behavior would furnish a key to all learning. This view has been advanced in recent years by the late Jacques Loeb.

The simplest theory of learning that has seemed adequate

[1] Cf. R. M. Yerkes, "The Intelligence of Earthworms," *The Journal of Animal Behavior*, 1912, *2*, pp. 332 f.; also C. J. Herrick, *Neurological Foundations of Animal Behavior*, pp. 139–40.

to account for the earthworm's behavior is stated in what has been called the *law of frequency of repetition*. In accordance with this law, any response frequently made becomes habitual. In the case at hand, the worm has two options: a turn to the right, or a turn to the left. If it takes one turn it gets to its burrow; if it takes the other it receives a shock which forces it to recoil and take the turn that was meant to be learned. Since the worm must take the proper turn, either immediately, or after the wrong turn has been made, it is evident that in the course of a number of trials the proper turn will be taken more frequently than the wrong turn, and will therefore become habituated or learned.

If all learning could be reduced to this simple *either-or* type, with one way open and the other closed, a theory of frequency as the sole basis of habit would be hard to overthrow. But since there are other kinds of learning which cannot readily be fitted into this scheme, we are forced to regard frequency of repetition as at best a partial explanation. Furthermore, frequent repetition of the act is not the only outstanding feature of the earthworm's learning. If it were, we should be at a loss to understand why the "intelligence" of earthworms is so variable that different individuals require from 20 to 200 repetitions in order to learn the act. But if, on the other hand, the earthworm learns by a "feeling" of progress, which is indicated by the unhampered expansion and contraction of its muscular rings in locomotion, we can gain a certain insight into

the difference between free-movement and movement disturbed by the effects of hindrance and recoil. The maze-test requires the earthworm to incorporate a turn to the right in its free-moving progress. It is unable to effect this incorporation in one successful, or one painful, experience, as can sometimes be done at a higher level of organic behavior; instead, it learns only in the course of a varying number of repetitions, each of which requires the incorporation of the proper turn under conditions more or less conducive to the development of a modified pattern of behavior.

Other things being equal, one might suppose that the worm which at the outset chanced to make the fewest left turns would learn the right turn most quickly; because the left turn, with the electric shock that follows it, must be a disturbing event. Whenever a positive attraction leads an organism in a harmful direction —as the attraction of a flame does the moth—inability to learn avoidance can be attributed to shock; and even a human being finds it difficult to learn to avoid danger when he happens upon danger by chance. Indeed, it is only when an organism is *expectant* in the literal sense of looking out for something to happen that it learns at all. Expectancy does not mean the anticipation of what will happen, but only a sense that something is impending. In other words, a prime condition of learning is a more or less lively participation in what is going on. If a circuit of behavior is in process of formation, the precise end of the circuit

may be problematical and highly contingent, yet certain conditions must be fulfilled if the circuit is to be completed. Without completion no configuration is established, and nothing is learned. Failure to establish a configuration is attributable to any sudden turn of events that brings one upon something unexpected; the response is then one of *dismay*. Dismay, however, may be followed by a speedy readjustment whereby the import of the sudden turn of events is assimilated with what went before. A stroke of humor is sometimes achieved in this manner; and the difficulty of remembering a joke is likewise explained by the disjunction between its antecedent and its consequent. Whatever we are unprepared for, we comprehend with difficulty; and the figure of a joke is apt to be less perspicuous than the more "sensible" figure which the same words, pictures, or events would normally suggest.

But difficulty of learning does not attach solely to an unexpected turn of events. A casual, even-flowing course of experience may be so loosely constructed that no circuit is closed, and, consequently, no definite impression is established. In the case of the earthworm, we may suppose that the positive side of its performance, as it turns again and again to the right, sinks in very gradually, because of a low degree of expectancy. When not hindered by dismay, a higher grade of intelligence can master a choice of left or right in a single experience.

The earthworm, far from demonstrating that the law of frequency is a fundamental law of learning, shows us that

mere repetition affords a doubtful explanation for learning, even at a very low level of behavior.

§ 55. *Assimilation*

A second main type of learning can be called *assimilation.* As an example, we shall select one of Köhler's experiments with an anthropoid ape.[1] A chimpanzee is shown a banana placed outside his cage just beyond his reach. Inside the cage is a stick with the aid of which the fruit can be secured. The ape in question has never previously been observed to employ a stick as a "tool," and does not now perceive any possible connection between himself and the fruit *via* the stick. Instead, he reaches vainly through the bars of the cage, and then busies himself otherwise; returning, however, again and again to the desired fruit, and repeating his futile efforts. If the stick itself becomes an objective, he seizes it and plays with it without any observable reference to the fruit. But if, perchance, the stick and fruit fall together in the line of his regard, the situation is suddenly altered; for the stick is at once seized and correctly used in securing the fruit. This transformation of the situation is not only sudden but lasting. The animal learns in one successful trial to employ a stick in order to secure a desired object which lies beyond his reach. And with this transformation of perception comes learning.

Clearly, this is not a process of "trial and error." At the outset the ape knows the desirable quality of a banana,

[1] Cf. *The Mentality of Apes*, pp. 103 f.

and also knows how to employ a stick; what he does not know is the bearing of the stick upon the fruit. This he must discover. When favorable conditions arise under which he can perceive stick and fruit together, the two enter at once into the situation and become members of one pattern of behavior.

Learning, as here described, is not a process of accretion. The ape does not associate the stick with the fruit by a gradual effect of repetition in which he sees the two so often together that they finally become fused into a single perception; neither does he gradually associate the manipulation of a stick with the reaching movement of his arm. On the contrary, what he sees, what he touches, and what he does with his body, arms, and hands, are all integral parts of one course of experienced behavior, any analysis of which in terms of different sensations or different movements would destroy the picture, just as the analysis of the partial tones of a musical clang will destroy the musical quality of a sound.

A perception is always a whole which cannot be analyzed without its destruction. But in destroying one whole a new whole may be created, which is a product of analysis. This is one of the ways in which perception operates to create new things to our view, and new responses in our repertoire of behavior. A low-grade instance of a simple modification of behavior, without a complete analysis which destroys the original pattern, was given in the learning of the earthworm.

But the method employed by the chimpanzee is different,

and is genetically later than learning by differentiation. Two previously created wholes may be combined to constitute an entirely new whole which embraces both as its constituent members.

Learning takes place by differentiation and by assimilation, these being what we commonly call analytic and synthetic methods. It should be made clear, however, that both the analytic and the synthetic methods create new forms of behavior. In neither case are we concerned with "elements," which are first found by analysis and later combined into some arbitrary assemblage; instead, we are always dealing with circuits of behavior which shape themselves in accordance with the principle of "closure" (cf. p. 127). It is a pattern and not a content which analysis reveals in the destruction of a previous whole, and in the creation of a new, though subordinate, whole. Likewise a synthesis of two or more wholes into a new and larger whole is effected pattern-wise and not by mere accretion.

When the ape learns to bring the previously neutral, or, as we should say, irrelevant, stick into the act of reaching for the fruit, he is creating such a synthesis. He does not merely add a stick to his perception of the banana; he incorporates the stick into his reaction upon the banana. In order to create this synthesis he must first be able to perceive sticks as well as bananas. But a mere perception of one and then the other is not enough; for observation has shown that until the favorable moment arrives in which the stick and fruit are seen together, a synthesis is not in the

slightest degree indicated. Even after the ape has employed a stick successfully on many occasions when he found it lying between himself and his goal, he will not necessarily seek a stick when one is not directly before him. Instead, he may try to get the fruit with quite useless "tools"—for instance, a wisp of straw—because they happen to possess the "longishness" of a stick and happen to fall within the range of his gaze upon the fruit.

A synthetic act of learning is an assimilative process, in which, under favorable conditions, previously acquired acts and their objectives are incorporated into a new act that closes the circuit in a situation where something is expected to happen. Expectancy operates here at a much higher level of "intelligence" than it does in the case of the earthworm, previously described; for now it describes a total-situation in which a disturbed equilibrium is phenomenally represented as a felt-want.

The analytic acts of learning are not different in kind, although they take a different direction. A part of a whole can become a focus of reaction quite as suddenly, and with the same creative impulse, as a new synthesis; but this is not always the case, because the membership of a part in the whole may be so pronounced that it cannot emerge as a distinct feature. Fundamentally, however, the two processes are inseparable. Integration goes hand in hand with differentiation, integration being but another name for a synthesis of behavior, and differentiation another name for analysis. But while analysis suggests breaking

something up into its constituent parts, differentiation, as we have employed this term in its biological sense, means a specialization of function within the pattern of a total organic response.

Under artificial conditions, however, differentiation will create parts that can be stripped of their membership-character and employed as independent, self-contained units. These artificial entities are the products of thought. Like partial tones, they are wrested from their natural context, and employed in a new context which they themselves must furnish in order that they may exist at all. These creations give us words and numbers, logic and mathematics—the "tools" of reasoning with which science and the humanities make what we call progress and civilization. It seems paradoxical that the advancement of knowledge should depend upon an artifice; yet all that this paradox signifies is that tools, whether they be words, numbers, machines, or what not, are but means to ends. Except in the very special context of rhetoric, or mathematics, or mechanics, they are not ends in themselves.

Behaving in a "real world" is not the same as behaving in an "ideal world." Even though the "ideal world" is derived from the "real world," and employed in its interpretation, the world of reality is never identical with the world of *signs* and *symbols*. However, the gulf between the two worlds is not impassable, for although signs and symbols are unreal, the forms they take are real. When separately heard, the partial tones of a clang give us a distorted

impression of the musical sound to which they belong; yet as tones they have the form of any other tones, and can be so designated. Although more subtle in their derivation, and more wide-reaching in the elaborateness of their special contexts, *words* and *numbers* are equally subject to the forms in which experienced behavior is cast. We shall have occasion later on to examine in greater detail the derivation of words and numbers (cf. § 64). For the present it will be sufficient to note, as we have done in an earlier chapter (pp. 21 f.), that bio-logic precedes formal logic, and supplies the patterns of all kinds of processes by means of which the circuits in behavior are closed.

§ 56. *Gradation*

Our illustration of the third type of the learning process is chosen also from the experiments of Wolfgang Köhler upon animals.[1] This experiment was performed in the first instance with hens, and then repeated with apes and with a three-year-old child. The purpose of the experiment was to test the capacity of choice between stimuli of the same sort which vary from each other in a certain direction, i. e., stimuli which constitute what we have previously called a *gradient.* Köhler employed two gray papers which differed only in shade. These were placed upon a board before the hen-coop, each holding an equal number of kernels of grain. The hen was then permitted to take food from the

[1] Cf. "Nachweis einfacher Strukturfunktionen beim Schimpansen und beim Haushuhn," *Abhandlung der K. Preus. Akad. d. Wiss.*, Jahrgang 1918, No. 2 (separate edition), pp. 12 f. Also Koffka, *op. cit.*, pp. 138 f.

lighter paper of the two, and was constantly "shooed" away from the darker. The positions of the two papers were interchanged at intervals, so that choice could not be determined by any other token than the shade of gray. After many trials, numbering in some cases from 400 to 600, the hen was trained to select the right paper almost invariably. A critical test was then made. For the paper of darker shade there was substituted a paper lighter in shade than the one from which the hen was allowed to feed (see Fig. 11). The result was surprising. Since it has

FIG. 11. (After Köhler.)

been commonly supposed that training, as here described, establishes an unequivocal connection between a certain stimulus and a certain response, one should expect the hen to continue to select the acceptable shade of the training-series. But this was not the case: instead, the hen chose the new shade, which was the lighter of the two papers.

With another hen, similarly trained, the critical test was made by retaining the unacceptable gray of the training-series, and pairing it with a still darker gray. In this case one might have supposed that the unacceptable gray would still be refused, and that the new shade, whatever it might be, would stimulate acceptance. But again the lighter of the papers was chosen.

Experiments have been made, both by Köhler and, quite

independently, by other investigators,[1] in which the criteria were positional references, right and left; differences of size, larger and smaller; and geometrical designs that varied in a constant manner. In all cases where the criterion was one that a hen can perceive, the same result was obtained. When due allowance is made for the more or less indefinite behavior of a hen in a situation requiring a definite response, based upon a perception that may at times exceed a hen's power of discrimination, we find that at this low level of intelligence the criterion of selection is the *direction* of change.

Similar results were obtained in experiments with apes, and also in an experiment performed with a three-year-old child. With older children, however, and with adult human beings, the results are different; for with higher degrees of intelligence selection is made more and more upon the basis of an individual criterion. When, however, the difference between the two stimuli is sufficiently small, a pair-wise selection becomes the only one possible. Under these conditions, even an adult human being does not realize that a new stimulus has been introduced, and therefore continues to make his selection on the basis of the direction of change that his previous training has taught him.

The conclusions we are bound to draw from these experiments are both profound and wide-reaching. They are profound in their demonstration of the fallacy of supposing

[1] Cf. A. Riekel, "Psychologische Untersuchungen an Hühnern," *Zeitschrift für Psychologie*, 1922, *89*, pp. 81 f.

that perceptual behavior is a one-to-one correspondence of discrete stimuli and equally discrete responses. The so-called "constancy hypothesis," that discrete stimuli provoke equally discrete sensations and movements, must be abandoned. If such a theory were sound, a hen would persist in selecting the positive criterion of the training-series in the critical test; and she would also persist in rejecting the negative criterion when it reappeared in a new combination. But instead, these experiments demonstrate that at the low level of intelligence exemplified by the behavior of hens it is not a discrete touch-and-go response that is learned, but a response to a *gradient.* This implies, first of all, a *direction* that is forced upon the hen during the training-series, and, secondly, a *transference* of this training to the critical test. The hen does not see and react to two gray papers as two, one here and one there; but she sees and reacts to a situation that contains a gradient of brightness-darkness. She can be trained to make her choice in either direction; though it is not necessarily a matter of indifference whether the positive response is towards brightness or darkness. In order to train successfully, it is necessary only that the direction of training be clearly evident; for some directions are preferable to others. A hen, for instance, can be more readily trained to select brightness than darkness. The up-grade, we might say, is more natural than the down-grade. What we have in any case is a configuration, the members of which, though ill-defined as entities, constitute a direction. Under

appropriate conditions any direction an organism is able to apprehend can be made to enter into a definite achievement. Once learned, a certain direction will be prepotent in any new situation where the same direction is given. Since this is the true basis for what is commonly called *transfer of training*, we see how wide-reaching are the conclusions we must draw from this simple experiment. A discipline is afforded to both mind and body by any training which gives direction to a form of behavior that will be called for at different times and in different situations.

Direction is given by the prepotency of one feature of the situation as compared with all others. This prepotency has its counterpart in the distribution of energy within the behaving organism. Consequently, it is not a matter of indifference to the organism what direction it shall take. If left to itself, that phase of the situation will be prepotent which constitutes the highest degree of stimulation. Other things being equal, the direction of choice will be towards the brightest, the loudest, the largest, the most pungent, or, in short, the most outstanding feature of any graded series of qualities.

Before a gradient can develop into two articulate entities, one of which is allowed and the other disallowed, thus making an absolute choice possible, a transformation must occur in the perception. This transformation is effected when the step taken in one direction becomes noticeable. What was originally a whole grading towards brightness or darkness, now becomes two wholes, one bright and the

other dark. One of these two is prepotent, not only as a member of the pair, but also as a unit that emerges from the general level of the behavior. Only then will a particular object be selected in varying contexts, no matter what its attendants may be.

In these simple facts the germs of a complete philosophy of education may be found. Beginning with a vague whole, the articulateness of which is somehow felt to be greater than the articulateness of its surroundings, the response of the organism will focus upon any outstanding or prepotent feature of this whole. This outstanding feature, or focus, is an accent of excitement; it may be inherent in the whole, or it may be arbitrarily introduced by external conditions that permit one direction of response and deny all others. In either case, the organism learns to respond to a direction within the apprehended whole. In other words, the organism perceives a gradient in the particularized situation-response. The quality and nature of this gradient, once it is perceived, is transferrable, and its prepotent aspect will thereafter dominate any future situation in which this same gradient is given.

It is by such means that we learn quantities of more and less. A child of two or three years playing with a dozen marbles fails to notice the removal of one or two from the group; but if he has only three or four marbles before him, and one of them is withdrawn while he is not looking, he is apt to miss it. A group-whole of four members is more readily comprehensible at this age than a group-whole of twelve

members. Three marbles look different from four marbles; but even an adult will find it difficult, without counting, to see the difference between a group of forty-seven marbles and a group of forty-nine marbles, unless they constitute a regular pattern (see Fig. 12).

With regard to the perception of orderly arrangements,

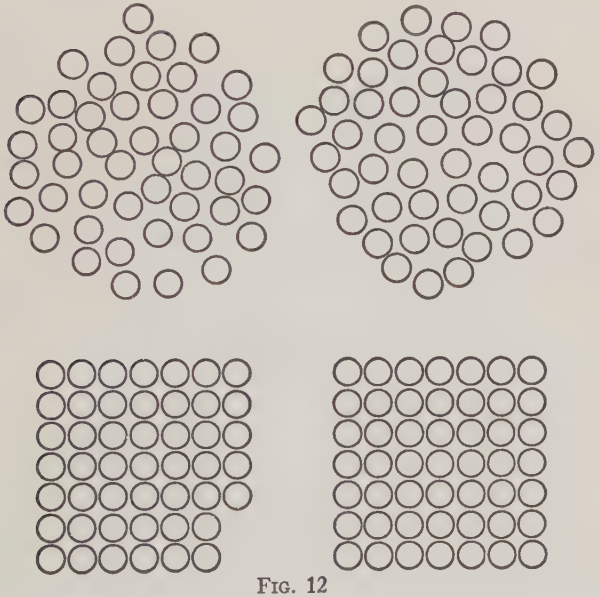


Fig. 12

Köhler's experiments with apes have shown the limitations of the chimpanzee's mind in several striking ways. In piling boxes one upon the other in order to reach fruit suspended from above, no ape showed any capacity to stabilize his structure. Even after many trials in which a successful achievement of the goal depended upon the gymnastic skill of the ape in mounting a very unstable

pile of boxes, no insight into the art of placing one box squarely upon another was ever indicated. All that an ape learns is to bridge the gap between himself and his goal by the crudest means of construction (see Plate I). The same crude method is employed by young children, and may be observed in any nursery when children are first introduced to the fascinating task of building blocks. A child, however, soon learns to perceive the effective stability of a regular pile, whereas an ape does not.

In experiments with a ladder, Köhler again found that even the cleverest apes were lacking in a capacity to improve their performance by learning to place the ladder properly against a wall. Instead, the ladder was used merely as though it were a pole, being propped in any way to give the needed extension towards the goal, and never, save by chance, was it placed in a stable position.

Another illustration of a primitive configuration that fails to reveal its orderly arrangement is given by one of Köhler's experiments with a swinging rope. A rope hanging from a fixed horizontal bar was readily employed by the apes, both in playful swinging, and as a means of securing fruit suspended from above. The loose end of this rope was slung twice about the bar in a simple, and, to an adult human being, clearly comprehensible coil. In order to employ the rope as a swing in the attainment of fruit suspended from above, it was necessary to uncoil the rope from the bar about which it was slung. At first, not a single ape was able to do this; instead they all did much

PLATE I

A chimpanzee piling boxes in order to reach fruit suspended in the air.
(From Köhler's *The Mentality of Apes.*)

as we do with a more complicated snarl of string: they pulled the loose end of the rope without uncoiling it. Later on, two of the cleverest of the apes did succeed in unwinding the rope from the bar; but the initial difficulty of perception was undoubtedly very real.

Acts of this order in which a configuration is defined, and an at first inarticulate mass becomes an articulate pattern, are the prototypes of intelligent behavior. Broadly speaking, every test of intelligence is a test of delineation. At the lowest level of intelligence the gap between desire and fulfillment is bridged in the crudest possible manner; yet the employment of a stick, a box, a jumping pole, a swinging rope, a ladder, or even the quite futile attempt to use any object that chances to possess the quality of extension, are all indications of intelligence.

§ 57. *Re-definition*

A fourth type of learning consists in re-defining a perception by a process of re-centering or re-focusing. Differentiation leads not only to the perception of gradients and scales, but also to different orientations in which the same pattern of apprehension and response becomes re-centered or re-focused without necessarily overstepping its original bounds. In the accompanying figure two simple illustrations of this process are given (see Fig. 13). In the first design (A) we can see three different things: 1) the plane figure of a hexagon embracing three lozenges; 2) a cube; and, by reversing the perspective, 3) the inside of a rec-

tangular corner viewed from below. Fig. 13 B also has three forms. The most obvious one, perhaps, is 1) that of a full-blown sail; the others are 2) a plane figure of a square with curved sides, and 3) something that comes as a surprise when we draw an imaginary line from the upper left- to the lower right-hand corner, and discover that the figure has assumed the shape of a shield.

Every change in either of these two designs gives rise to a distinct figure quite different from the earlier perceived ones. There is no overlapping, and the change in perception comes as suddenly and as completely as it does in the previously described case of learning by assimilation. Furthermore, every line of the drawing is involved in each perception. There is neither an addition to nor a subtraction from what is given; instead, the same lines and angles enter into distinct patterns. This is what is meant by re-definition; which can also be described as a re-centering, re-focusing, or re-orientation of the figure.

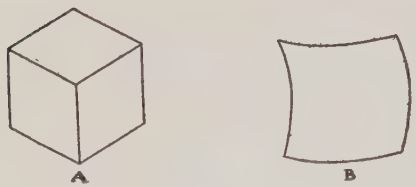


FIG. 13

Problems of this kind have given no end of trouble to analytic psychology. If perception is only a sum of sensations, then the changes these figures undergo must be attributed to sensations other than those conveyed to us by the design itself. Such an explanation is commonly sought in terms of the sensations of eye-movement. In

addition to merely seeing the figure, the eyes are supposed to move differently when the figure is perceived first as one thing and then as a different thing. We have already pointed out the difficulty of such an explanation in a much simpler case where the eyes move from one point to another (see p. 113). If the sensations of specific eye-movements cannot explain the difference of orientation in two sets of equidistant points placed side by side, it is unlikely that

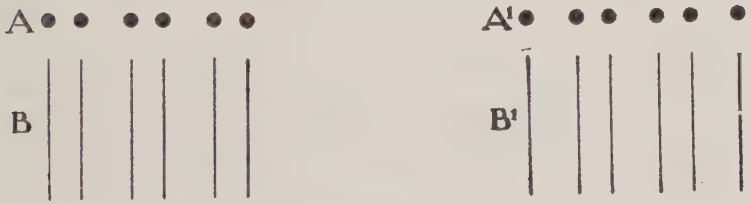


FIG. 14

an addition or subtraction of sensations can be made to explain the difference between the perceptions of a hexagon, a cube, and a corner; or between a sail, a square with curved sides, and a shield.

Similar alterations in orientation are possible with other perceptual materials. A series of dots and lines, arranged like those in Fig. 14, can be perceived in different ways. In the first set of dots (A), the pairs closest together readily form a figure with spaces between them. In the set (A′), however, where we have the same spacing but begin with the second dot of the first series, it is the wider-spaced dots that fall into pairs. The same difference will be found in the two series of lines (B and B′). Recent studies have

shown that the spaces between these dots and lines do not constitute a homogeneous background; instead, whenever two dots or two lines form a figure the space between them becomes a part of the pair and attains a kind of firmness or solidity, whereas the surrounding space remains soft and indefinite.[1]

Articulation and cohesion of the same order attach to groupings of sound and of contact in rhythmical phenomena. The time elapsing between the beats of a single measure is somehow "filled," while the time between measures is "empty." In other words, the members of a figure are not merely added together with nothing between them; instead, they constitute a whole, every portion of which is filled out, just as the canvas of a painter must be filled out to the edges.

Some designs, however, can be filled out in different ways, so that within a constant boundary different figures are possible; this is what is meant by *re-definition*. While applying only to equivocal figures, which are more prominent in advanced than in primitive learning, it would be a mistake to regard re-definition as a freak of "intelligence." Genetically there is something closely akin to re-definition in the learning of the earthworm, where, as it has been shown, the subsequent turning to the left is more readily acquired than the original turning to the right (see p. 246). This fact seems to indicate a kind of re-definition within the total-behavior of crawling forward, when a left-turning is

[1] Cf. K. Koffka, "Perception," *Psychological Bulletin*, 1922, *19*, pp. 553 f.

substituted for a previously acquired right-turning. Furthermore, re-definition frequently occurs in acts of behavior when, on account of the subtle rhythm of the pattern, we are unable to discern the equivocal phase; and yet, so far as muscle and gland are concerned, the same response is being repeated in different situations with quite different meanings.

This, again, is one of the reasons why a formal discipline is so significant in education; for by means of re-definition a technique acquired in one situation can be employed in another and quite different situation. It is sometimes supposed that all education is "specific," meaning that what we learn are specific things and acts which are useful in a new situation only in so far as the new situation possesses elements or procedures identical with the things and acts previously learned. The fallacy of this supposition is amply demonstrated by those equivocal figures of apprehension and response which become univocal in several different ways. Many gestures and facial expressions have this equivocal character; without an appropriate context we do not know what they signify. An expert pantomimist will teach his spectators what his facial expressions and gestures are intended to convey by clearly defining his movements and repeating them from time to time in a similar context. But without the aid of the verbal "legends" interspersed in the film, the performance of the average "movie-actor" would be quite unintelligible; because he has not acquired this art of the pantomimist in organizing his movements into definite and unequivocal patterns.

§ 58. *Clever and Stupid Errors*

Having reviewed the four chief types of learning, we must next say something concerning the errors and the technique of the process. In studying the behavior of primitive mentality we must be careful to interpret the data justly. The mistakes committed by an ape, or by a child, are often quite as significant as the successful achievements. Errors can be divided, generally, into two classes, which Köhler calls "stupid" and "clever." A stupid error is one that indicates no insight into the configuration that is being employed. When an ape fails to bring a box or a stick to bear upon his situation, and gives vent to his thwarted desire by mishandling the one or the other, that is stupid. Stupid, also, are the less frequent attempts to employ a habit acquired in one situation in another where it does not belong.

In the puzzle-box experiments of Thorndike,[1] instances of this second kind were sufficiently numerous to lead him to conclude that the behavior of animals is essentially stupid. After a cat had been trained by the trial-and-error method to release itself by pulling at a latch-string hung in the fore part of the cage, it was found that if the string were hung at the rear of the cage the cat would often go to the spot where the string had formerly hung and make a futile effort to pull what was no longer there. This behavior is undoubtedly stupid, because it shows that the cat did not perceive the string as an essential feature of its behavior.

[1] Cf. E. L. Thorndike, *Animal Intelligence* (1911).

On the other hand, the foundation such errors give to the conclusion that all animal-behavior is equally stupid is not so firm as Thorndike thought it to be; for the simple reason that a puzzle-box is an inappropriate means of testing intelligence. If one wishes to test an animal's intelligence, which, according to our definition, is the animal's ability to transform an inarticulate mass into an articulate pattern, one must provide conditions under which articulation may be expected. These are not the conditions of a puzzle in which one chances to hit upon the solution without knowing how one has achieved it.

Primitive perception, like that indicated by Thorndike's cat, has been aptly described by H. J. Watt in the following passage:

> The whole complex is a somewhat indefinite unit that can know nothing of the abstraction of qualities traditionally associated with the idea of perception, as exemplified by the orange, with its touch, taste, smell, surface, etc. . . . We can gain further light on this primitive state if we look for an example in our own conduct. Many people understand very little about the mechanism of the simplest machinery. They do not even trouble to look at the parts of it. They learn how to use it by rough trial, aided by some simple verbal instruction or by imitation, but if anything goes wrong, they are quite incapable of repairing the defect. If the nut on the under side of the lid of a metal teapot or under the seat of a bentwood chair loosens, it is allowed to unscrew gradually ("this is getting loose," they say), it falls off and is thrown away ("the nob of this lid has come off"), and the article is then "broken" and useless. Such an object must be a very vaguely defined percept in such minds. Parts of it that are not essential for use dis-

appear unnoticed, and efforts are made to use the thing when its essential parts have gone. To the expert or observing mind this seems as stupid as the cat pawing for the loop that is not there.[1]

Instead of denying all intelligence to a cat or a dog because of the stupid behavior these animals exhibit in situations that are highly artificial to them, and which even a human adult would not always be able to comprehend, we must begin our study of intelligence with situations in which the animal is at home, and then, by the introduction of obstacles and hindrances to the attainment of a desired end, select first those which demand only the slightest extension of natural or previously acquired modes of behavior. Köhler's experiments are significant chiefly because he was able to devise and carry out his elaborate investigation of apes by this procedure. Beginning with a test that proved too difficult for his animals, he soon learned something of the animal's limitations, and was then able to plan a succession of tests that became progressively more difficult until the limit of the animal's intelligence had been reached. Abandoning altogether the puzzle-situation which hitherto had been the chief method of studying animal-behavior, he has demonstrated that an ape placed in a natural situation, and not subjected to coercion, will make very few stupid errors.

On the other hand, an ape makes many clever errors which give valuable insight into the nature of his, and, in-

[1] Cf. *The Sensory Basis and Structure of Knowledge* (London: Methuen, 1925), pp. 202 and 204.

deed, of all intelligence. It is chiefly upon Köhler's results that our definition of intelligence as articulateness of pattern is based. A clever error is one in which, although the gap between a desire and its fulfillment is not adequately bridged, the attempt made indicates the nature and the limits of the animal's intelligent insight at the time, and under the conditions of the experiment.

In one of Köhler's experiments, requiring the use of boxes, fruit was hung from the ceiling near a wall at such a height that a single box gave an insufficient elevation to reach it. Not having mastered the employment of two boxes, one upon the other, the ape tried various ways to reach the fruit with a single box, finally bracing the box in his arms against the wall at an elevation which would have enabled him to reach the fruit if only the box had stuck there. This is an instance of a clever error, since it indicates a certain insight into the nature of the task.

In another experiment, neither of two bamboo sticks was long enough to reach the fruit outside the cage, but if the two sticks were fitted together by placing the one of smaller diameter into the hollow core of the other, they would give the needed length. Two clever errors were committed in attempts to fulfill the requirements of this test. One consisted in holding the two sticks together end to end in order to secure the adequate length. The other consisted in pushing one of the sticks very carefully towards the goal by means of the other until the gap between the ape and fruit was actually bridged. In both cases, the result was

futile; yet each of the attempts clearly shows that the ape was operating with an intelligent insight into the need of bridging the gap by a longer tool than either of the separate sticks supplied.[1]

§ 59. *Technique and Intelligence*

Fitting two sticks together to make a longer one was successfully achieved by Köhler's ape, *Sultan*, the cleverest of the animals with whom he worked.[2] The first achievement was apparently a result of chance. Sultan at the time was manipulating the sticks in the manner described above in the first of the two clever errors, namely, attempting to secure greater length by holding the sticks end to end. The chance result of slipping the smaller one into the bore of the larger was immediately understood, however, for Sultan, who was sitting idly on a box with his back half turned from the fruit, at once sprang towards the bars of the cage, and began to poke after the fruit. When the two sticks fell apart they were quickly put together again; and so delighted was he with the employment of his newly made tool, that after he had fetched in all the fruit he did not stop to eat, but continued for some time to angle for other objects of no particular value to him. The act of fitting the two sticks together was so well learned on the first occasion that the following day Sultan was able to fit three sticks together. Furthermore, a special series of tests on stick-fitting indicated that a technique natural to

[1] Cf. *The Mentality of Apes*, pp. 129 f.

[2] Cf. *op. cit.*, pp. 130 f.

PLATE II

A chimpanzee fitting a small stick into the bore of a larger one.
(From Köhler's *The Mentality of Apes.*)

the procedure was employed from the start. Instead of a tedious trial-and-error method, with gradual improvement until the habit was formed, the ape would almost invariably grasp the stick of larger bore in his left hand, and employ his right hand to fit the smaller stick into the first (see Plate II). With three sticks of different bore placed before him in varying order, this selective procedure was in the main correct from the start. When on one or two occasions the larger stick was picked up by the right hand and the smaller one by the left hand, they were exchanged almost as soon as they were grasped.

In view of this technical proficiency, it has been suggested that the fitting of small objects into holes of an appropriate size must be instinctive;[1] and a parallel instance is found in the technique of birds in nest-building, where a small twig will be fitted into a chink or hole in the nest. Obviously, a performance so skillful as that of Sultan in selecting and fitting sticks together must have had some antecedents in behavior; nevertheless, the experiment introduced to him a new situation which for the first time in his life called for the exercise of this particular act. A ready technique characterized every ape's employment of a stick to fetch objects lying beyond the reach of his arm. The first attempt to bring a stick to bear upon the hitherto unattainable fruit was not, as one might suppose, a crude perception of stick and fruit manifesting itself in a groping behavior; instead, the ape at once placed the stick correctly

[1] Cf. Koffka, *op. cit.*, pp. 217 f.

behind the objective, which he then drew carefully towards himself.

To say, however, that these manifestations of technical skill in the performance of acts not hitherto exercised must be attributed to instinct is not to explain them at all. Granting a capacity for skillful coördination of movements, we have found our problem in the perception itself, rather than in any antecedent behavior. Broadly speaking, the ape is a skillful animal. Prior to their captivity, all of Köhler's apes had undergone a wealth of experience calculated to make them behave with grace and poise. All that was needed to call forth these manifestations of skill in a new performance was an appropriate perception of what was required. Thus, the well-known pattern of grasping with the hand controls and determines the new configuration of grasping with a stick. Drawing the object towards oneself requires the placing of the stick beyond the object, just as it requires the placing of the fingers beyond the object. Indeed, so strong is this feature of the configuration that one of Köhler's tests, requiring the desired object to be first pushed away from the ape before it could be brought forward and seized upon, proved to be so difficult that only the cleverest animals were able to master it.

This "detour" experiment [1]—as Köhler calls it—was also found to be a good test of intelligence. The experiment was performed with the aid of a "detour-board" constructed like a drawer, the rear end of which was lacking. This

[1] Cf. *The Mentality of Apes*, pp. 239 f.

drawer was placed outside the cage with the closed end towards the animal. Upon the floor of the drawer near its front wall was placed a banana (see Fig. 15). With the aid of a stick the ape could secure the fruit by first pushing it away from himself until it was outside the confines of the drawer, and then bringing it forward by the usual method hitherto employed.

FIG. 15

Only two of the apes were able to solve this problem; and in the behavior of each there was an obvious reluctance in pushing the desired object away in order to get it around the corner of the drawer. For those apes who could not master this indirect method of securing the fruit, the board had to be turned so that the opening was no longer directly opposite, but inclined to one side or the other. Repeated tests with all the animals demonstrated that every one could solve the problem at some angle of rotation between the original position of 180° opposition and a position of 90° with the opening of the drawer at one side. Furthermore, the largest angle in which the task was successfully accomplished by each ape proved to be an accurate measure of the intelligence of that particular ape; for the rank-order shown by the results of this measurement was the same as the one determined by the general behavior of the apes in the other experiments in which they had taken part.

The significance of this method for testing intelligence

is considerable, because it supplies so simple a means of grading the difficulty of the detour. A similar method was employed by Köhler with children, sometimes confining the individual rather than the objective in a pen with an opening at the rear. One little girl of fifteen months, on looking over the barrier of the pen in which she found herself, and spying a piece of candy outside, glanced about her, gave a satisfied laugh and then made the circuit around the wall to the place where the candy lay. A boy of twenty-four months evinced less intelligence with the "detour-board"; for after a futile attempt to reach over the barrier, he threw the stick and also his belt at the objective.[1]

The nature of the intelligence needed in the solution of a detour-problem is not different in kind from that employed in the more direct task of securing an objective with the aid of a stick, or a box, but it does involve a complication which can be mastered only by the inclusion of an indirect response within the configuration. The instinctive pattern of fulfilling a desire by the gross means of attraction and avoidance is refined, not only by the inclusion of an appropriate technique, but also by the inclusion of an indirect response within the scope of the original direct response. In order to make a detour intelligently one must "bear in mind" the end, and fit the indirections of one's behavior into the ultimate fulfillment. The more arbitrary the detour involved the more difficult it will be to preserve this unity of action. At an advanced stage in

[1] Cf. *The Mentality of Apes*, pp. 13 and 193.

his progressive series of tests, Köhler set one of his apes the task of securing fruit placed on the ground outside the cage by means of a stick suspended from above. In order to get the stick it was necessary for the ape to stand on a box. The box was placed in such a position that it would have to be carried past the fruit. When, box in hand, the ape came near the fruit, his path was deflected by the attraction of the objective, and instead of proceeding on his way to the stick he stopped and began to use the box as if it were a stick. The same motive was here operative which made it so difficult in the detour-board experiment to proceed in a direction contrary to the source of attraction.

An important pedagogical hint may be derived from these facts. So long as one can work progressively in a single direction the difficulties of refining one's method and elaborating one's procedure are relatively simple; but when an indirect course must be followed, the introduction of a cross-current that seems to lead more directly to the goal is likely to be disruptive and confusing. Since learning consists in working out the intricacies of a pattern, sound pedagogy will always counsel a direct attack. As a test of intelligence, however, the indirect task is an excellent device, since it is calculated to reveal the extent to which an individual is able to hold fast to his goal in the face of distraction.

§ 60. *Summary*

Let us conclude this long chapter with a summary of the general facts revealed by the experiments we have recounted.

Learning, we have said, falls into the four general classes, *differentiation*, *assimilation*, *gradation*, and *re-definition;* each of which is based upon *particularization*. The configuration to be learned, may or may not possess a *gradient;* and the gradient may or may not be articulated as a stepwise procedure.

At its lowest level, learning by differentiation was exemplified in the trial-and-error procedure of the *paramecium*. Here nothing was learned that seemed to extend beyond a single encounter with, and an adjustment to, an obstacle in the organism's path. Repeated encounters with similar obstacles incite the same behavior of recoil, turning, and forward motion, until the obstacle is cleared. The repeated attack upon the obstacle leads to a differentiation in the direction of approach; but there is no perception of the objective, and hence no improvement in behavior.

A higher and more lasting form of learning was shown by the procedure of the earthworm in threading a maze, where the differentiation of behavior consisted in the incorporation of a choice of turns at a point in the worm's path. Further progress in differentiation takes place at a still higher level of learning when a feature of a course of behavior can be clearly distinguished. In this way the objective of behavior is defined, and particular events separated one from another.

Learning by assimilation depends upon learning by differentiation. The process transforms and unites things and events hitherto individual and distinct. By assimilation, the ape incorporates the use of a stick into the act of grasp-

ing. In like manner we are constantly learning to incorporate things previously known for themselves alone into configurations where they surrender their individuality and become members of one whole. As we shall see later on, the same principles that apply to things and events apply to ideas, and are, indeed, the principles of all logic, beginning with bio-logic and the logic of things, and culminating in the formal logic of ideas and concepts.

Learning by gradation was illustrated by an experiment with hens, where a "transfer" occurred between one pair of grays and another pair through retention of the same gradation. From the apprehension of a gradient we come to the possibility of "absolute choice," in which individual members are particularized where previously there was only a uniform gradation. The individuation of a step in a scale is a higher type of learning than that shown either in the modification of the earthworm's behavior, or in the sudden definition of a particular act or objective of behavior. Whereas a "particular" remains always itself, a scale and its steps are transferable to other situations than the one in which they were acquired.

The progress of graded differentiation in the case of a child might be traced as follows: At first the child knows nothing of boxes as containers of candy. If a box of candy is given to him, he discovers its contents only upon opening it. Two boxes of candy, which are alike except that one is larger than the other, are then placed before him. He is allowed to take, let us say, the larger, but not the smaller.

The child soon learns to select the larger of the pair, and will then be able to transfer this training to other pairs of boxes, the outstanding feature of which is a difference of size. At first, he responds to a *pair;* but later he learns to differentiate the two boxes, and respond separately to the one he takes, and the one he rejects. After having learned to particularize the two boxes, he may be in doubt whether he should choose a box which he now recognizes to be the one that previously held candy, or a new box which is the larger of the two. The particular box, however, soon acquires greater significance than the pair, and unless the difference in size is so slight that individuation is difficult, he will usually make an "absolute," rather than a "relative" choice.

Re-definition, the last of our four classes, shows itself as a distinct type of learning whenever a certain thing or event can be re-focused or re-centered so as to achieve a new configuration. Changes of this order are to be found in the so-called "illusions" of reversible perspective, where the same outline will produce two or more distinct spatial forms (cf. Fig. 13A). Re-definitions occur not only in visual forms but also in movements and glandular secretions, which can be repeated in different perceptions with quite different imports.

CHAPTER XV

THE PATTERNS OF LEARNING

§ 61. *Formal Principles*

Whenever a gradation in apprehension or response is indefinite or equivocal, the configuration it establishes is subject to consolidation in the direction of greater simplicity. This simplification has been previously referred to as the *law of precision* (p. 237). The complicated perceptions of human beings are not always characterized by gradations that can be laid down upon a simple linear scale of opposites, such as *high* and *low*, *bright* and *dark*, *large* and *small*, *intense* and *weak;* there are many other gradations, the scale of which cannot be so readily and exactly determined. Perceptions may be *hard* or *soft*, *sharp* or *blunt*, *smooth* or *rough*, *warm* or *cold*, *exciting* or *depressing*, *simple* or *compound*, *articulate* or *inarticulate*, *contoured* or *vague*. Indeed, we might go on indefinitely with this list of descriptive opposites, many of which overlap because the terms are not capable of exact definition. But aside from the adequacy of these terms, each of them describes a functional gradient which retains its formal identity throughout the range of experience. In other words, what we mean by any opposition transcends the particular modality of sense in which the adequacy of the term is most pronounced. *Hard* and *soft*, for instance, may seem more adequate in describ-

ing experiences of contact with the skin than experiences of sight; yet the formal significance of the term *soft* makes it applicable to a nebulous spring day, and the term *hard* is equally appropriate to a clear bright day of winter. Although the employment of *hardness* and *softness* in the description of a landscape indicates a transfer of meaning, we are dealing not merely with the transfer of tactual impressions into the field of vision, but also with the transfer of a relevant perceptual configuration. As simple qualities of visual sensation, hardness and softness may be altogether inappropriate terms of description; but in a *landscape* the effects of hardness and softness are just as marked as they are in a perceived contact with the skin.

These numerous and varying gradients in the phenomena of perception are functions of the phenomenal figure and ground, and vary with variations of both figure and ground. To analytic psychology, intent upon the response made to a simple stimulus when the organism is freed as far as possible from all influences of variable context, these gradations assume a very definite place in description, and in some instances can be measured in terms of simple variations of the stimulus, such as intensity, duration, and vibrational frequency. We, however, are more interested in the concrete behavior of the organism to larger and more significant forms than we are in the analytic details of the configurations themselves. Since the situations of school and of everyday life are never the restricted situations of a psychological laboratory, we cannot suppose that what is true

in the laboratory can immediately be transferred to concrete situations.

If the gradients of practical everyday behavior were different in kind from the gradients of a strictly psychological analysis, we should be dealing with unscientific concepts. This, however, is not the case; the gradients of a certain modality of sensation are the variables of a very limited configuration of sense-perception, yet these same variables are found in the larger configurations of everyday behavior, together with many others which do not appear in the laboratory of the analyst because they have no function to perform in the restricted situation of a laboratory response.

While the response of a single sense-organ will focus upon the prepotent features of that particular modality of sense, the response of the total-organism will focus upon any outstanding feature in the situation that confronts the entire organism. The discrete response to a gradient of a particular sense-modality is attained only by a differentiation of the total-response of the organism. In practical behavior the total-response is never a simple summation of discrete responses to discrete gradients. Behavior in the laboratory is different from behavior in a concrete practical situation, and we cannot assume that practical responses are merely a sum of the different types of behavior which experiments under restricted conditions have revealed. This does not mean that laboratory experiments are useless for an understanding of life and education, but merely that we cannot overlook the pattern of synthesis

when we come to interpret human nature in the light of our experiments.

As students of behavior we should look first for the focus of a situation. This outstanding feature may be an inherent accent of excitation which the sensitive organism finds for itself; or it may be arbitrarily determined by external conditions that permit a response in one direction and deny it in others. In every case where the response is not of the "all-or-none" type, a gradient is established which gives direction to the behavior. This gradient is perceived as a form, the quality of which is transferable. That is to say, the prepotent accent which directs the behavior will reappear in any future situation possessing the same gradient. Once the gradient of a configuration is established, its repetition is subject to the law of precision; the configuration will constantly assume a greater simplicity, and may at the same time achieve greater degrees of refinement.

In one of his experiments in the choice-training of apes,[1] Köhler employed a series of five colors, *blue*, *indigo*, *violet*, *purple*, and *red*, to designate the direction of choice. At first he tried to train the animals with two adjacent colors of this series, but his effort was in vain; no ape could at first distinguish colors so near one another as *indigo* and *violet*. He then employed two colors separated by one grade, such as *indigo* and *purple*, which the apes learned to discriminate without difficulty. After this training had been successfully carried out, Köhler returned to the finer

[1] *Nachweis einfacher Strukturfunktionen*, pp. 67 f.

discrimination of the adjacent colors, and found that the apes were now able to "transfer" their training, and choose the redder or the bluer of any two colors in the series. It appears, then, that a gradient which at first manifests itself only in a crude manner refines itself once it has been established.

This application of the law of precision is of great importance to education, because we are constantly dealing with gradations, the finer nuances of which can be learned only in this way. It has sometimes been supposed that where sensitivity to color is involved the degree of sensitivity is *absolute*, being given once and for all by a native capacity. But, as Köhler's ingenious test has now demonstrated, it is not the absolute data of sense, but the pattern of arrangement—the gradient—that determines discriminative action; and all finer discriminations must be prepared for by grosser discriminations within the same pattern of gradation.

§ 62. *The Origin of an "Outer World"*

We have seen that the process of behavior, with its articulation into precise patterns, is a progressive affair, beginning with an undifferentiated response of the "all-or-none" type and proceeding towards a highly differentiated objective as the goal of endeavor. By means of this differentiation the objective establishes its residence in the "outer world." Instead of the "outer world" being the projection of an "inner world" which has priority, the two concepts "outer" and "inner" are created together, true

priority attaching to the matrix of them both. An "all-or-none" response embodies an organic want and its fulfillment—a direction of behavior and an objective the possession of which closes the circuit. At a primitive level, the psychophysical organism, as "subject," does not stand apart from its "object"; for there is, as yet, no clear differentiation between the two, either phenomenally or in the behavior that is taking place.

We have studied the process of differentiating "subject" and "object" chiefly by reference to experiments upon the learning of animals, because the observation of animals enables us to comprehend the beginnings of this differentiation more clearly than the observations that have been made upon children. Although a human being is capable of carrying all these differentiations of behavior and its objectives to a much higher degree of perceptual definition than any other animal, the greater differentiability of human nature is itself a hindrance to experimental observation. The potentialities of human beings are so enormously rich that it is much more difficult to trace a clearly defined direction of behavior in a child than in an ape. Yet, wherever we can trace a specific pattern of behavior throughout human infancy, we find the same processes of differentiation and integration going forward which characterize the learning of other animals.

As an illustration of this fact, let us take up the behavior of an infant learning to grasp objects. The original touch-organ of the suckling babe is not the hand but the mouth.

After the fourth week, or thereabouts, every object that comes to the mouth is sucked. At first, the infant brings to the mouth its hands and sucks them; later it will bring to the mouth and suck any object of suitable size that it may chance to grasp. The head as well as the hands move in the effort to make contact with the mouth; but at first the eyes seem to play no part. In the case of one infant,[1] the participation of vision was first noted on the ninety-ninth day after birth, and even then the sight of the object touched seemed to be quite casual. It was not until some two weeks later that the same child used sight in grasping an object. The first adjustments of an object to the hand under the guidance of sight are quite as awkward as the original efforts to find the mouth by touch. Furthermore, it was not until the seventh month that this particular infant began to play with objects without bringing them to the mouth.

In this way an object differentiates itself from the dynamic pattern of behavior in which it is at first incorporated. Conditions alter gradually, so that in time the intrinsic aspects of the thing itself, as a separate configuration that appears and reappears upon different backgrounds, leads to a definition of its contour, and a consolidation of its internal structure. From this point onwards perception is largely concerned in distinguishing things detached both from the observer as "subject," and from his behavior.

[1] Cf. Millicent W. Shinn, "Notes on the Development of a Child," *University of California Studies*, I, 1893, pp. 306 f.

Things become objects existing in their own right upon a ground that is separated from the perceiving organism. These things, together with the ground upon which they appear, constitute the " outer world" in which the observing and behaving creature now finds a varied assortment of differentiated and differentiable features. Whereas the first steps in education are chiefly concerned with the dynamic patterns of learning to act, later steps are taken in the "outer world" that now spreads objectively before the learner.

§ 63. *The Creation of "Signs" and "Symbols"*

The principles in accordance with which the "outer world" is constructed are in no wise different from those that determine instinctive response and acquired modes of behavior. In every case objects and aspects of behavior are first distinguished as members of larger wholes. After they have been thus distinguished they can be reincorporated into new wholes. But a "whole" is never a mere aggregate of parts; neither is the incorporation of previously defined parts into a whole a mere summation of those parts. Yet, despite the radical transformation effected by these changes in behavior, the principle of *genetic identity* still holds. Different as it is from its antecedents, a new whole is always achieved by one of four processes: *differentiation*, *assimilation*, *gradation*, or *re-definition;* and with the aid of this knowledge it is always possible to trace the genesis of any whole.

It would be incorrect, however, to say that we respond only to forms arising by these natural processes. Under the artificial conditions created by "intelligence," both summation and fractionation have important parts to play. Consequently, many of the data with which human adults concern themselves are not true configurations at all. Numbers and words, as well as particles of like and unlike nature, can be combined and separated in arbitrary ways. *Signs* and *symbols* that represent something other than themselves function in artificial procedures not given in direct perception. While signs and symbols have their origin in concrete experience, they are made to function *abstractly*, that is, independently of the setting from which they have derived. Furthermore, the artificial worlds of number, word, gesture, etc., have patterns the relevancy of which to concrete perception is not immediately felt.

When the "outer world" is once separated from the "inner world" there is no necessary correspondence between the two. The subjective side of an experience can be configural or non-configural; and so, too, its objective side. For instance, the lines of crayon with which a square shape is drawn upon a blackboard do not constitute a physical configuration; the chalk-grains possess no inner cohesion, and some of them can be erased without in any way affecting those that remain; and yet the "squareness" we apprehend when we look at the board is a configuration, and will persist even after a certain portion of the chalk is erased. Again, patterns of radiant energy are physical configurations

which can be apprehended only under special conditions, and then only in forms that differ from those of the energy itself. For this reason our knowledge of many physical phenomena has been late in coming, and a comprehension of electricity, radio-activity, and like phenomena is still very difficult for those who do not understand the forms of expression employed in mathematical and physical terminology.

In becoming educated, one must acquaint himself not only with the "real" forms of nature but also with many "unreal" forms. Indeed, a large portion of schooling consists in introducing the reluctant mind to symbolic and more or less arbitrary devices of expression and communication. The task is not a simple one. While most persons of so-called normal intelligence achieve a certain degree of mastery over the three R's, it is only an exceptional person who can distinguish "real" from "unreal" truth, and know when he is dealing with facts, and when he is handling counters. Yet along this line of distinction lies higher education, which consists in learning the significant forms of nature and their expression in speech and writing, in numbers and mechanisms, which the ingenuity of man has devised.

§ 64. *Naming and Numbering*

Although a detailed consideration of the origin of naming and numbering is properly a subject of child-study, a brief résumé of these important developments will serve us as concrete instances of the manner in which representative forms of expression are derived.

I. Naming [1]

Naming starts with the vocalizations of infancy called "babbling." Not only does the infant laugh and cry to express its states of comfort and discomfort, but it soon gives utterance to a variety of sounds that shape themselves in accordance with definite phonetic principles. Thus, in large measure, all infants babble alike, irrespective of racial antecedents or surroundings. The selection of sounds for repetition in specific perceptions is partly made by those who care for the infant. Although such sounds as "ma-ma," "pa-pa," and "ba-ba" seem to be universal, their allocation to *mother*, *father*, and *baby* may be subject to external influences. In any event, the connection these utterances acquire with perceptual situations is of such a nature that instead of being only signs for things and events, it is now commonly agreed that they are "sentence-words" which designate felt-wants (cf. p. 224). The call "ma-ma" is not only an utterance that belongs with the perception of the mother, but the expression of a desire to be fed, to be comforted, to be "changed," etc. Indeed, the fond mother is often quite discerning in her ability to detect in the nuance of the utterance what particular want is being expressed.

Much later in the course of the child's development comes the naming of objects and events, and with it the discovery that objects and events have names. One of the characteristic utterances of this period is the question:

[1] Cf. Koffka, *op. cit.*, pp. 319 f.

"What's that?" (*Wa's 'at*). Here a desire for something is supplanted by the desire for a name that will take its place. In learning that things have names a child not only incorporates his own natural utterances into his behavior, but also feels the want of a specific utterance which he may be unable to supply. The name, when given by the child's attendant, becomes at once an important feature of the thing. If the name fits readily into the child's mode of utterance, it will be imitated; otherwise it simply incorporates itself into the perceived pattern and becomes a motive for the response that previously belonged only to the thing itself. Gradually, the patterns of speech form themselves in audition and utterance, the rhythm and melody of speech being grasped before definite articulation has been mastered. Thus, a child will talk to itself without signifying anything one can understand, and yet in cadences so natural that if heard from a slight distance one might easily suppose that the child was carrying on a conversation.

One of the interesting steps in the development of language is the first usage of words like *this*, *that*, and *one* to designate an object without specifying it. While a new stage in the development of a special linguistic sign, this is not altogether a new usage; because such a word as "pa-pa" may be employed for any man by a child who in reality does not confuse his own father with other persons whom he calls by this name.

The chief thing to be noted in linguistic development is the incorporation of sounds and their utterance into the

patterns of perceptual behavior. The very selection of sounds and their articulation is much more intimately connected with configurations of behavior than we are apt to suppose. Professor Carl Stumpf refers to a word coined by one of his children as the name of a peculiarly shaped stone. The word was "marage"; and even after the child had grown to youth he contended that the stone in question still looked like that sound. Onomatopoësis in childhood is not always so indefinite as this instance suggests; but no one can doubt that Professor Stumpf's son found a real likeness between the sound of the word "marage" and the stone to which he gave this name. A somewhat similar instance of a strange likeness between different words is shown by the remark of a little girl, aged three years and eleven months, that "bamboozled"—a word that had struck her in the conversation of her elders, and the meaning of which she did not at all comprehend—"was a funny word; just like *mah jong*."

The designation of objects and events also leads to the creation of new words by the process of assimilation already described as a method of learning. An example of this is the naming of the crescent moon as a "banoon" by a little girl of three years and five months. This word obviously incorporates "banana," which the crescent resembled, with "moon." Similar instances are frequent in the employment of verbs, such as "goed" for *went*, "runned" for *ran*, and "throwed" for *threw*. The words of a sentence will often be disarranged, although the form of the sentence is pre-

served. Here is an example in the form of a question asked by a child at the age of three years and one month:

Do Nannie want you me dress to?

The proper order being:

Do you want Nannie to dress me?

The child was calling to her mother from the upper part of the house, which may in part explain why, in her anxiety to be heard, so many words were misplaced. It is remarkable, however, that the three verbs retained their proper positions, and that, despite the medley, no word was omitted.

The interest children take in rhymes, assonances, and alliterations also indicates a formal quality in the beginnings of speech. As an example I may cite the following song composed by the previously mentioned little girl at the age of four years and three months. While riding in an automobile along the shore of a lake she improvised a song, the principal phrases of which were:

Water slipping in the sails,
Water slipping on the lake.

As if pleased with the sound of the lines, she repeated them again and again with slight modifications. In addition to the meter, the melody, and the repeated words, one notes the alliterative *s*'s in *slipping* and *sails*, the assonance of *sails* and *lake*, and the repetition of *l* in all three words.

It is safe to say that if we gave more heed to these qualities of speech at the time when they are so potent a factor

in linguistic attainment, we should encounter less difficulty in teaching style and composition in the later years of education. Instead of struggling to teach oral and written composition by the arid means of grammar, syntax, and rhetoric, we might, if we but knew how, cultivate the rhythms of speech as they appear spontaneously in childhood. Then, when undertaken, the formal study of language would be an explication of methods already largely in use, rather than a re-introduction to natural forms of composition which have been lost because too great emphasis was placed upon naming things and events, and too little emphasis upon the rhythm of expression.

II. Numbering [1]

While a primitive mind can discriminate groups and their members, it is incapable of counting, adding, and subtracting. In order to accomplish these feats two things are necessary; first, the designation of the several members of a series by counting; and, secondly, the designation of the cumulative result of addition. While numbering implies both, each must be learned for itself. A group of homogeneous units has a configuration unlike that of a group of heterogeneous objects. The homogeneity of a handful of marbles, or a succession of equally distributed pencil-strokes, is perceived, and can be designated by a child as "one, another one, another one," etc. If the child is then taught to call this series *one, two, three,* etc., what he learns first is the names of these positions. He will always start at the

[1] Cf. Koffka, *op. cit.*, pp. 332 f.

beginning; and if the beginning be the left-hand member of a horizontally placed series, that member, and not the right-hand member ending the series, is *one*. Furthermore, these number-names apply, at first, only to the members of the series in which they were learned, and not to the members of any other series. After having learned to count his fingers, a child will not necessarily be able to count those of another person; because the names he has been taught belong exclusively to his own fingers. Yet he can soon learn to realize the configurative likeness of any homogeneous series without regard to the quality of its members; and counting is mastered whenever separate objects, even though heterogeneous, can be named from beginning to end as *one*, *two*, *three*, etc.

But counting is only a positional reference; the child must yet learn to combine the naming of positions with the cumulative result of grouping. It is an achievement to realize that *three* not only names the third member of a series, but also stands for the first three members taken together; in other words, that *three* is not only the name of one member, but also of a group.

These are the two main features of numbering which develop in the process of naming things in a series. By distinguishing these features we are able to see why numbering does not occur "naturally," and must therefore be taught. Numbering must, of course, have "occurred" some time, or we should have no science of mathematics; but the "occurrence" was surely in a mature mind, and not

in the mind of a child. Furthermore, number-systems are so artificial that many primitive races get on without them; and mathematics remains an impenetrable mystery to some civilized persons of a fair degree of intelligence.

Yet the disciplinary value of a mathematical procedure is such that no well-trained mind can dispense with its elementary processes, and a poor foundation in mathematics may exercise a baneful influence over one's entire career. Without a clear insight into the principles of numerical abstraction, the delineation of things suffers a loss which, in our man-made world, often puts one to a serious disadvantage. To be able to perceive and handle things in accordance with the way they "look," without counting them, may develop a finer technique in a cook or a hunter than any numerical survey could supply; but in other operations, involving the exchange of money, the measurement of land, or the estimation of large and otherwise incomprehensible groups of things, lack of mathematical insight may mean disaster.

It should be the aim of education to keep alive the intuitional guidance of common-sense in the appraisal of things, and at the same time to instruct the young in mathematical devices for checking-up and interpreting these appraisals. This is no easy matter; because too great a reliance upon intuition makes one careless of the checking-up process, and too great a reliance upon mathematical interpretations causes one to lose his intuitive insight. We have already noted, in reference to the "lightning calcula-

tors" investigated by Binet (cf. p. 215), that an astounding technique in the employment of numbers is not necessarily coupled with a high degree of general intelligence. Even a mathematician of eminence can be less capable in dealing with practical affairs than a person of native shrewdness whose mathematical ability is slight. For the purpose of a general education, however, a certain modicum of training in mathematics is a great asset; and it has yet to be shown that there are any minds of first-rate ability that cannot profit by mathematical instruction when it is properly administered.

The problem of education is not so much to select some persons for mathematical study and excuse others, on the basis of a native disposition or talent, but to see to it that all who possess normal intelligence are so instructed that they will learn to grasp the significance of the number-system and its operation; for such knowledge is an indispensable aid in the definition of behavior. It is quite possible for one to be both mathematically and intuitively minded; to keep in touch with reality, to appraise it by means of the way things "look" and "feel," and at the same time be able to subject these appraisals to an accurate calculation.

§ 65. *The Limits of Perception*

Since the law of precision operates in the direction of greater simplicity and stability, configurations must approach limits. These limits can be stated and their implications described with the aid of appropriate signs and symbols.

Accordingly, we have typical forms that serve as abstract norms, such as the *point*, the *line*, the *surface*, and the *solid* of geometry. Each of these arises from a limiting case of perception. A line, for instance, has length but no width. By reducing the width of an extended perception, one side of which is distinguishable from the other, we approach and eventually achieve the perception of a line, one side of which is no longer distinguishable from the other. Since a possible extension is always suggested beyond its perceived ends, a line is never itself a good configuration, though it may serve to bound a surface, such as a circle, a square, or some other inclosed figure, which *is* a good configuration. The unextended width of the line, however, is a limiting aspect beyond which we cannot go without losing the perception altogether. In the geometrical point we again have a limiting case of perception, this time with respect to all its dimensions. In contrast with the line, a point is complete and self-contained; it suggests nothing beyond itself, and is therefore a precise and stable configuration.

Precision operates both in the definition of standard types of stable and unmodifiable figures, and also in the definition of certain aspects of figures which, themselves, may be either stable or unstable, complete and final, as in the circle and square, or indefinite, as in the line. Whenever a figure, or an aspect of a figure, achieves this limiting condition, the law of precision is fully satisfied. The figures and aspects defined in this way serve thenceforth as norms

to which other similar figures and aspects converge. Thus, we perceive a circle in a figure only approximately circular, a line in a narrow band, and a dot in a small irregular spot. Whenever we encounter difficulty in carrying out this process of convergence, the divergent, non-conformable aspects of the figure are specially observed and accounted for; as, for instance, a circle with a protuberance, a line with a bulge in its width, or a streaky dot. In other words, a motive is given for an exact description and mensuration of the divergencies.

We arrive at mensuration by an agreement upon a certain norm of figure or aspect that can be employed as a unit which "goes into" other figures a certain number of times. Units of measurement cease to be natural members of the configurations from which they derived, and become absolute entities of universal application. Under the rules generated in their application, they acquire an existence of their own. One no longer thinks of a foot-measure as being the length of a human foot; and the metric system, now universal, has no association whatsoever with naïve perception.

After having achieved a level of accuracy, exact mensuration is no longer in necessary agreement with perception. Consider the geometrical illusions in which straight lines are perceived as curves, and lengths or widths grossly underestimated, or overestimated (see Fig. 16). While perception converges towards norms, the application of units of measurement derived from these norms shows up the discrepancy between fact and appearance. It makes a considerable

difference in one's space-percept on whether or not one has been trained in geometry. After such training, one can no longer *see* the world as he saw it before; instead, many subtle corrections are introduced in the employment of the terms and concepts which the study of geometry has defined.

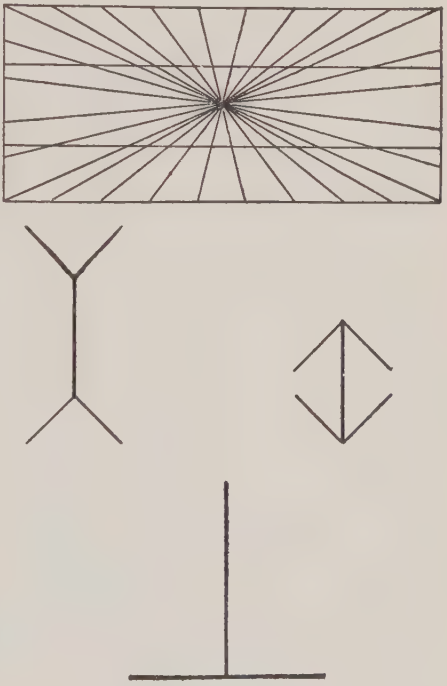


FIG. 16—The horizontal lines passing across the upper figure appear to be curved; the vertical lines of the middle figures appear to be of unequal length; and the vertical line of the lower figure appears to be longer than the horizontal line upon which it rests.

An experiment reported by Rubin will illustrate this point.[1] With the aid of a simple device permitting the formation of an angle of equal sides which could be varied from 0°—a vertical line—to 180°—a horizontal line, Rubin pointed out to his observer the *sharpness* of the acute angle as it approaches 0°, and the *bluntness* of the obtuse angle as it approaches 180°. He then set his observers the task of constructing an angle which should be neither sharp nor blunt. For those observers who had stud-

[1] Edgar Rubin, *Visuellwahrgenommene Figuren* (1921), pp. 108 f.

ied geometry, the task was immediately fulfilled by the construction of a right angle approximating 90°. But not so for those observers untutored in geometry; for them there was no such theoretical bias, and they were at a loss to make a precise estimate. No one of Rubin's three observers untrained in geometry even approximated a right angle. Instead, their estimates averaged, 107°, 69°, and 75°. Rubin remarks upon this difference of perception that originally an inclosed space emphasizes the structure of the space inclosed; whereas with greater erudition the emphasis shifts to the contour of the space. In geometrical training the angle is emphasized, rather than the space inclosed by the lines that meet to form the angle. Properly speaking, an angle which is neither sharp nor blunt is not identical with a right angle; it is a segment of space with a pointedness neither sharp nor blunt. A right angle, however, is composed of two straight lines meeting end on end in such a way that one of them is perpendicular to the other; here the inclosed space and its "pointedness" are negligible factors.

§ 66. *The Constancy of Perceived Forms*

Certain forms of perception maintain themselves despite a considerable variation from their normal appearance.[1] Although schooling gives insight into these variations, the correction suggested is sometimes so artificial that, although we know it must be true, it does not appear to us to be so.

[1] Cf. Koffka, *op. cit.*, pp. 284 f.

Among constant forms, three types are outstanding: those of 1) *magnitude*, 2) *color*, and 3) *shape*.

I. Constancy of Magnitude

Within the spatial surroundings to which it belongs an object does not appear to alter its magnitude perceptibly. Although the image cast by a man upon the retina of my eye suffers considerable variation in size as the man approaches or recedes from me, I do not ordinarily notice this change unless the man enters a different domain of space. I detect no alteration in the man's size as he moves towards me or away from me in a room, or in a large hall, or even out of doors, provided we are both occupants of the same space. But if I am indoors and observe a person outside through a window, he may impress me as being noticeably smaller than he would be if he were in the room with me. Alteration in size is especially noticeable when there is a difference of elevation. Persons seen on a tower may look like pygmies; and so likewise persons on the ground when seen from an elevation. But within the space to which an observer has adjusted himself, the things belonging to that space do not undergo the changes in magnitude which the alterations in the visual angle of perception suggest that they should.

That constancy of magnitude holds also for lower forms of life than man has been demonstrated by Köhler in the behavior of apes.[1] After a choice-training in the selec-

[1] Cf. "Optische Untersuchungen am Schimpansen und am Haushuhn," *Abhandlung d. K. Preus. Ak. der Wiss.*, Jhrg. 1915, Phys.-Math. Kl., no. 3.

tion of the larger of two objects, a critical test was made in which the larger object was removed to a distance at which its visual magnitude would be less than that of the smaller object. Despite this change, and under conditions so carefully controlled that only the visual magnitude of the object was altered, the apes continued to choose the objectively larger object. It is therefore difficult to believe that, as is sometimes supposed, constancy of magnitude is altogether a matter of "experience." Surely the experience of an ape cannot be very great in the way of suggesting corrections for apparent magnitudes in order that an object may continue to exert the same influence at different distances.

II. Constancy of Color

We all know that a blue object retains its hue under artificial illumination when the rays of light are so yellow that they cancel the effect of nearly all the blue rays that are being reflected from the object. The same thing is true of other familiar colors. This effect has usually been termed illusory, the error being attributed to familiarity with the object's color. But constancy of color is something more than a result of experience. Experiments have shown that the surface-color of an object is very stable, and persists in spite of considerable change of illumination. Constancy of color is especially noticeable when shadows are cast upon an object, for the surface-color remains what it was even when the shadow assumes an opposite or contrasting hue. Such effects disappear as soon as the perceptual situation

is altered by eliminating the object's context. If we look through a tube, and see only a flat surface, the color is no longer affected by the nature of the object, its form, or its surroundings; but so long as we see the object amid its surroundings, the surface-color will persist. In a winter's landscape, when the ground is covered with snow and the sky completely overcast with heavy clouds, the snow still looks *white* and the cloudy sky *gray*, even though the snow, which receives its light from the sky, must be the darker of the two. If we are able to compare snow and sky where they meet at the horizon, we shall be surprised to find that the sky is indeed the brighter.

That constancy of color derives from the totally-perceived situation, and not from memory, has also been demonstrated by Köhler in certain of his experiments with hens.[1] After choice-training with papers of different brightness (see pp. 255 f.), which led the hen to select the lighter of two grays, a shadow was cast upon the lighter paper so that it became actually darker than the other; and yet the hen continued to select the objectively lighter paper. We can hardly suppose that a hen's memory is sufficiently detailed to enable her to make a correction for this change in illumination by substituting a "memory-color" for the darker shade she now sees.

III. Constancy of Shape

In spite of the distortion that takes place when a certain shape is seen from different angles, it is a commonplace ob-

[1] *Optische Untersuchungen*, pp. 56 f.

servation that we continue to see it "as it is." In reality a table-top is usually square or oblong; a plate is round; the fundamental directions of space are given by the horizontal plane of floor or ground and by the up-standing verticality of the objects upon it. Yet we seldom see any of these things in precisely this manner. A table-top is more apt to be seen as rhomboidal and a plate as elliptical, while the fundamental directions of space are subject to all sorts of variation according to the position from which the world is viewed. If constancy of shape were a result of experience we might expect a skilled draughtsman to be more influenced by it than an unskilled drawer; yet the opposite is true. Without a certain talent for drawing, one meets with the greatest difficulty in rendering perspective; the seat and back of a chair in the drawing insist upon assuming their squarish shapes and rectangular position. Indeed, it was not until the period of the Renaissance that painters rediscovered the laws of perspective known to the Greeks and Romans, and began to make drawings in accordance with these laws. Previously, they had been so much influenced by constancy of shape that the angles with which square objects were portrayed always approached right angles, and the greatest care had to be exercised in selecting an aspect of the object that would permit its representation with the least amount of perspectival distortion. One also thinks, in this connection, of the conventionalized human figure of Egyptian reliefs, where head, legs, and arms are in profile, and the trunk in full frontal view. Unusual as this posture is, the

human form can thus be made to assume its most significant contour with regard to all its members.

Even after re-discovering the laws of perspective, the Renaissance painters soon found that these laws could not be slavishly followed; some concessions had to be made in order to bring out the essential shape of the things represented; otherwise the things would appear quite unnatural. In a "still-life" representation of a plate one will often find that the plate is rounder than it should be, or else that the sides, near and far, have been reduced in curvature so as to approach horizontal lines; both these devices seem to correct the artificiality of the true ellipse. Artistic devices, employed to correct and render more emphatic the essential shape of things, are numerous. For instance, a photograph taken from a position poorly chosen often renders an essential shape quite ambiguous. Both the painter and the photographer must exercise skill in registering the shape of things so as to overcome the distortion that perspective and other conditions impose.

The essential shape of an object develops from its internal structure. While the shape is defined by the object's contour, which, when precise, is also dependent upon the object's ground or surroundings, this precision of contour, in relation both to internal structure and background, is largely a product of erudition. As we have seen from Rubin's experiment in estimating angles (cf. p. 301), a geometrically trained observer will perceive otherwise than a naïve observer. The same is true with reference to per-

spective and its laws. If we know nothing about the concentration of lines at a point on the horizon, we do not perceive that things recede in this manner, and will not be guided by this fact in our drawings. It has often been observed that when a child first shows interest in pictures he makes no effort to see them right side up, but will pick

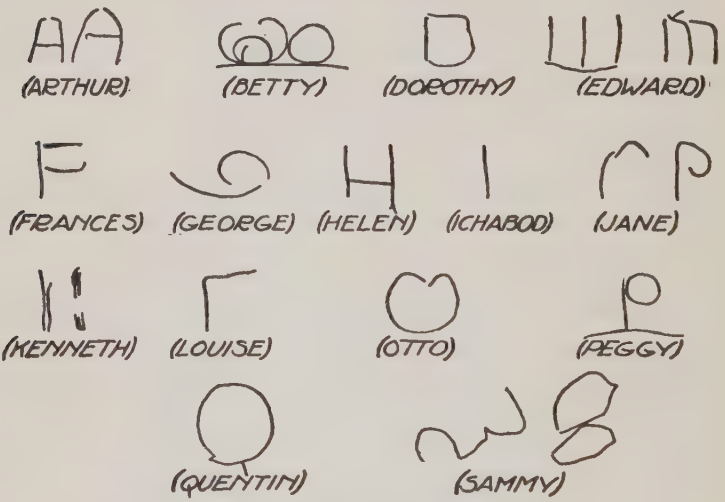


FIG. 17

out a familiar object in the picture quite as readily when it is reversed to his view. His drawings, too, like those of primitive man, show a much greater heed to essential shapes and features than to their setting.

Figure 17 reproduces certain letters of the alphabet drawn from memory by a little girl five years old. The letters had been learned from a set of doll-blocks, each of which had been given a name having the initial letter that appeared on the block. Thus, the boy doll-block *A* was

"Arthur," and the girl doll-block *F* was "Frances." The child was asked to draw the names of the blocks she could remember. It will be seen that all the drawings were made with reference to the fundamental directions, horizontal and vertical, excepting *S* which in this respect is somewhat ambiguous, both in the drawings and in itself. *A*, *D*, *F*, *H*, *I*, *K*, *O*, *P*, and *Q* are correct in position; but *B*, *G*, and *E* are on their sides, *E* being drawn twice with its arms reversed. *J* is simply upside down in two reproductions, while *L* is both upside down and reversed. Although the normal positions dominated the series, there was no indication that other positions were less satisfactory, excepting perhaps in the cases of *E* and *S* where two different drawings were made.

IV. Summary

Constancy of shape indicates the operation of the law of precision in the establishment of definite, normal configurations. While we cannot suppose that a child perceives nothing at all until a "good" figure happens to occur, we can say that prior to the occurrence of the "good" figure neither apprehension nor behavior is precise. Furthermore, when the "good" figure does occur, it possesses an accent of "rightness" that other figures lack. This accent of "rightness" is so impressive that it leaves the figure prepotent in the subsequent perception of slightly divergent shapes.

Normal patterns gradually increase in number and interrelatedness until at length we possess a variety of cate-

gories sufficient to embrace all our ways of action and apprehension. Original patterns of behavior are determined by the action-system of the organism; but this system is itself as much a product of behavior as of the architecture of the body. The discrimination of objectives follows the differentiation of those features of behavior which have a relative independence of structure. Differentiation proceeds by graded responses that succeed an "all-or-none" type of action. At first there is a mere direction of action; steps are then distinguished in the directed course; the steps next become units; and the units finally become abstracted as the artificial entities of a rational procedure in which things are accounted for, added together, and subtracted one from another. These artificial entities are the signs and symbols of reflective thought to which we shall turn our attention in the following chapter. Before leaving the topic of perception, however, let us clearly note that the signs and symbols of thought have no other origin than a perceived objective. Towards this goal behavior is directed, and, as conditions permit, the objective amplifies and consolidates itself into a type or norm of perception towards which divergent shapes converge.

CHAPTER XVI

THINKING AND REASONING

§ 67. *The Beginnings of Formal Logic*

In thinking and reasoning we employ signs and symbols as surrogates of perceived aspects of things and their contexts. These surrogates enable us to define perception with an artificial exactness which is not warranted by direct observation. While in origin these signs and symbols are factual enough, their abstraction from the full course of perception, and their differentiation as norms of behavior, involve the creation of a new and special set of configurations which we call *categories of thought.* These categories are of various sorts, such as verbal, numerical, graphic, mechanical, and tonal designs, leading to such disciplines as grammar and syntax, mathematics, descriptive geometry, mechanics, and music. Each discipline generates its own laws of continuation and precision, articulation and contour, closure and fulfillment. Operations with these abstracted data lead us into a new and artificial world, the creation of man's mind. This is the world of logic, with its formal methods of dealing with facts. Arising as it does from perception, logic follows the fundamental principle of closure; but whereas the forms of reasoning are the forms of behavior, they are not a direct counterpart of life, but a formulation of life in artificial terms. In order to avoid

idle speculation, these formulations must constantly be checked up with perception. Furthermore, there are at least two other kinds of logic with reference to which formal logic must direct its course.

In the first place, there is the *bio-logic* previously discussed in these pages. The logic of the organism *per se* expresses the laws of development and behavior without abstraction or discernment. The organism itself is moved by dominating influences and directions, not by abstractions; and we can find no justification for formulating its behavior as a sum of particular acts. Yet this is what we incline to do, because bio-logic is constantly furnishing material for formal logic, and formal logic in its turn is constantly shaping hypotheses on the basis of these materials. Since formal logic consists in classifying everything by clean-cut divisions, it is very difficult to avoid the prejudice of a preconceived terminology. But although we think discerningly, our acts are fluid, and have no such sharply cut edges as a logic of discernment suggests.

In the second place, formal logic must be constantly made to agree with the *logic of things*. The non-living physical facts of existence also have their logic, discoverable by observation and subject to formulation in abstract terms. Here, again, reasoning must be on its guard to register the facts adequately, and to build hypotheses consistent with the logic of the things about which one is reasoning. Although physical things lack the fluidity of organic behavior, they are not set in molds of thought.

What their patterns of action are must first be observed experimentally before the mind is free to determine their existence, and to plot their courses.

§ 68. *The Stages of Reasoning*

Let us now try to trace the development of the reasoning process which enables us to formulate both the facts of life and the facts of inert matter. In this development we can distinguish three stages.

I. Particularization

The first stage is the dichotomous separation of any given thing or event from everything else. We call this process *particularization* since the thing or event under consideration is specified. This specified particular is in contradictory opposition to all the rest of existence; it is *A* against *not-A*, which implies the logical *law of identity*. Anything at all must belong to one of these two classes, *A* or *not-A*. If it belongs to *A*, it is identical with it, but if it belongs to *not-A*, it is not specified. The "all-or-none" type of response falls within this category.

II. Gradation

The second stage of reasoning is achieved when a particular has also the figure of a gradient. Whenever a particularized thing or event varies from left to right, or from head to foot, or when a movement is made this way or that, we have the beginnings of differentiation. Within the figure any differentiation of direction, or of more and

less, raises it from the "all-or-none" to a higher level of response. The reasoning that applies to this stage not only specifies the thing or event, but also takes account of the directions, movements, dimensions, changes, etc., that are included in the figure. We are confronted not only with a thing or an event, but with a particular that extends or moves in a certain direction.

III. Articulation

The third, and final, stage of reasoning has to do with the *scale of articulation* within a gradient. A mere gradient from left to right is not the same as a figure that possesses a left side and a right side. While the gradient is only an emphasis or accent one way or another, the related aspects of the two sides of a figure give it an articulation; the figure is embraced by its boundaries, and these boundaries can be abstracted and dealt with separately. *Steps* will then appear in the gradient; what was formerly a continuous whole, leading in one direction, now divides itself into a scale of articulated parts that can be separated and defined. Whenever a serial order of steps appears, we have the possibility of *quantification;* taking the step as a unit we can proceed to find out how many times this unit will go into the whole.

Here we have the beginning of our concepts of *similarity* and *difference*, and such categories as *equality*, or quantitative likeness, and *identity*, or qualitative likeness. Both quantitative and qualitative likeness and difference are aspects of gradients that make themselves felt only after

the gradient has distinguished its steps and become an articulated scale. The opposition of extremes, such as black and white, great and small, long and short, is now for the first time manifest, whereas in the beginning there was only the dichotomous opposition of *A* and *not-A*.

In other words, reasoning, as we know it, dealing with terms and counters that stand for things and events, their appearances and disappearances, comes about only at this third stage in which a scale is discernible in the articulation of a specified figure. The identification and separate employment of a step in a scale—such as a certain length, a certain weight, or a certain velocity—means the creation of a new, though artificial, configuration: new because it has not previously disentangled itself from the gradient to which it belonged, and artificial because it possesses reality only as being the length or weight or velocity of some thing or event.

Reasoning operates with these abstractions. At first it builds crude *ideas*, representations with ill-defined contours and uncertain articulateness, more or less amorphous figures of mind composed of imagery and feeling which initiate and control certain directions of behavior. But as the contour and internal structure of these figures are defined, they become *concepts*, the members of which are logically ordered. The idea now purports to be true, accurate, embracing such abstractions from the perception of things and events as are essential to an adequate formulation of these things and events. In the intellectual world of

reasoning, the definition of ideas as concepts takes the same course and follows the same law of precision that guide the refinement of action in the acquisition of skill and the definition of the objective in perception. There are no new principles or processes in reasoning. The *stages* of reasoning which we have outlined would apply as well to stages of learning to perceive accurately. The only unique thing in reasoning is the employment of *surrogates* upon which we may reflect, and with which the mind may operate in the absence of perceived data.

It is improbable that surrogates are largely employed by any animal save man; yet other animals evince intelligence and a capacity to reason within the limits of perception. We are therefore led to conclude that, unique as is the development of man's thinking in terms of abstraction, his *achievement* is not different in kind from the achievements of reasoning at a perceptual level. Furthermore, although the achievements of one who thinks are vastly greater than those of one who does not think, a reasoning that pursues its course at the perceptual level is essential to many human accomplishments, and may even mark a superior intelligence. Intellectual operations in terms of abstraction, although characteristic of all thinking, remain a subsidiary method of reasoning. Lacking ability to think, as we have thus defined thinking, the ape, no matter how clever he may be, is always inferior to man. And yet man's mastery over nature is attributable not only to his capacity to think, but also to his ability to refine upon his

perceptual contacts with nature. His refinements are primarily a matter of reasoning in the same way in which an ape reasons. But man can reason to better effect than an ape, because man has a greater variety of means for attaining his goal. Among these various means is thought.

§ 69. *Judgment*

The process of definition is called by logicians *judgment*. Psychologically, definition signifies the refinement of a configuration, with respect both to its contour and to its inner articulation, the direction of refinement being determined by the law of precision. Accordingly, crude and variant forms simplify themselves, and disjected members seek their proper places in the wholes to which they belong. A judgment states this process of refinement by referring the crude or variant form to its norm, or by stating the relation of the disjected member to its proper whole. Although judgment appears first at what we have described as the third and final stage of reasoning, it has its biological antecedents in earlier stages of development. Whatever is particularized possesses a cohesive internal structure that implies a membered whole, even though its members cannot be separately discerned. It is for this reason that the whole sets itself off from the rest of existence; the statement of this fact, made from the level of the third stage of reasoning, is the judgment that X is either A or *not-A*. At a primitive level, however, X and A must be one undifferentiated whole, because if X were *not-A*, it would not come into consideration at all.

At the second stage of reasoning, precision and assimilation are both operative. *A* now has a special direction; the "all-or-none" response has given way to a graded response; selection is now made upon the basis of this gradation, as well as upon the less articulate features of the whole. Although the selective agency of direction can operate without discernment, it furnishes data for a more refined judgment than that of mere particularization. When, from the vantage-point of the third stage of reasoning, we pass judgment upon the behavior of the hen in Köhler's choice-training experiments, we must include in our statement the differential gradient of lighter-darker, larger-smaller, right-left, or whatever the gradient may have been, as well as the "togetherness" of the two food-plates which made them a single objective to the hen. A kind of oppositeness is introduced at the second stage of reasoning which qualifies the particular act as it stands in contradictory relation to its surroundings.

While it is only at the third stage of reasoning, in which the articulate members of a gradient are separately discerned, that a judgment can be made upon refinement or assimilation, a judgment can state the conditions of primitive reasoning as well as those of an advanced level. With a scale of articulation at one's command, judgment can be passed upon all the stages of reasoning: simple dichotomous opposition, directed opposition, supra-ordination, co-ordination and sub-ordination.

§ 70. *Volition*

Appearing itself only at the third and highest stage of reasoning, judgment is volitional rather than instinctive or habitual. That is to say, whenever I pass judgment, I not only employ an articulated scale of the members, parts, and graded steps of wholes, but I also participate in sanctioning the decision that is reached. This self-participation in judgment exercises a kind of censorship that distinguishes *volition* from *suggestion*. A judgment is always *willed;* it is not a mere statement of observed fact, but a statement biased by the articulated scale employed in the statement of the fact. In other words, this scale is *my* scale, which I have acquired by discernment, and now employ *knowingly*. Consequently, judgments show both insight and the participation of "self." I can judge this color to be brighter than that one; but a hen, whose behavior is determined by the mere gradient of brightness-darkness, exercises no volition in following this direction. We see, then, that choice is not always judgment, though judgment always requires choice. Volition is present only when we perceive and think with reference to our own personal categories of perception and thought. In suggestion, however, these same categories, though operative, are implicit and not explicit. We do what is suggested, but not what we know we ought to do.

When we speak of the *fiat* of the will, which controls and determines thought and action, we mean that the configuration of one's own person is serving as a special context that colors and defines the chosen action. In sugges-

tion, on the other hand, the configuration is impersonal, and the action goes forward with an objective accent. The primitive communal action of a group, while it requires full participation upon the part of all members of the group, is controlled group-wise by sympathy and suggestion, not by fiats of will on the part of the participating members. There is no more judgment in such a communal action than there is in the choice-behavior of a hen. In the hen, however, where the choice of action is individual, the subject is so completely merged in her own behavior that no distinction is drawn between volition and suggestion. The hen does not will; neither is she highly suggestible, even though she can be "hypnotized" by placing her head under her wing. While a hen's behavior in choosing is determined both by her dispositions and by her surroundings, the two are not clearly enough separated to make the usage of the terms *volition* and *suggestion* of any significance.

§ 71. *Habituation*

In addition to modes of behavior determined by instinct and volition, there are also the modes of *reflex* and *habit*. Obviously, the reflex is not a result of judgment; and neither is a habit at the time of its performance. Yet habituation may follow upon judgment, so that what we now do habitually may originally have been willed. We have already pointed out the likeness of habits and reflexes as regards their "touch-and-go" nature (cf. pp. 38 f.). Habits are freely employed in carrying out the configurations of both volition

and suggestion; and while they possess the relative independence of reflexes, like reflexes, they are also subject to variation and self-regulation as members of larger currents of events undertaken by the entire psychophysical organism.

The formation of a habit takes place whenever a special act becomes stereotyped and thus ceases to be the focus of a configuration. By re-focusing and re-centering, certain acts fall into a subsidiary place. Sometimes they disappear altogether; but if they have become hardened and stereotyped through repetition and precision, they will continue to function without being specially perceived. Thus, like a reflex, a habit takes care of itself, so long as the conditions do not positively interfere with its activity.

This process of fixation and regulation attaches to certain forms of behavior, and to certain types of dispositional readiness for apprehension and response. The requisite fixation of a habit may derive from instinctive behavior, from suggestion, or from volition. Many habits are acquired without our ever passing judgment upon them—we do not even know that we have them unless they are pointed out to us. So far as the general economy of life is concerned, some are "good," and some are "bad" habits, while many are neutral—useless, though harmless.

Habits arise from an instinctive impulse whenever the pattern of the behavior that supplies this impulse becomes stereotyped. In anger, in fear, in love, and in social behavior, one exhibits certain mannerisms that are attributable

to this source. No judgment was ever passed upon their formation. The same is true of habits originating in suggested behavior, where, without the censorship of volition, one participates in conformity with the pattern of circumstances. In our behavior we conform both to the social group of which we are members, and likewise to the tools we handle and to the objects of our environment. Stocks and stones, the life of nature, the artificial constructions of man, the prevailing landscape and weather—all these things, living and inert, possess dominating influences which force us to conform to their patterns and directions. Accordingly, both idiosyncrasies and conventions harden upon us as habits, the origins of which are too subtle for us to trace even when we become aware of their existence.

In addition to habits upon which judgment can be passed, although judgment had no part in their formation, there is a class of intelligent habits which we both sanction and strive to form. Judgment ceases as soon as volition is no longer required to hold us upon a chosen course. What is at first acquired by painful effort and under strict censorship, later becomes second nature to us. In this sense all learning is habituation; but in learning with the aid of judgment we are not merely fixing in habit something that seems to be right, we are also actively engaged in judging whether or not it is right. Habits of mind are not like the conventions of society or the habitual mode of an instinctive expression; for they depend upon insight and a mastery of the scale of articulation to which they belong. One may

be as stupidly uncritical in the exercise of a habit of mind as he is in the exercise of a habit of body; but at least the mental habit arose from critical discernment, whereas the bodily habit may have taken shape without recourse to judgment of any sort.

This does not mean, however, that, once formed, mental habits are more dependable than bodily habits, or than the conventions of instinct and the suggested ways of man. A closed mind is the greatest handicap to human progress, and mental habit is responsible for this closure. Whenever judgment ceases to operate, mind is dead; and while habits of mind can be of the greatest service to thinking, they must be kept fluid and subject to constant revision and censorship, or they will dominate our lives more completely and more banefully than any habits of involuntary origin ever can.

§ 72. *The Pedagogy of Judgment*

In teaching children to reason and to think we must always make sure that the child is actually passing a judgment; that he sanctions the steps taken in the development of the subject, and comprehends the classification made of the material embraced by the subject. The teacher's scheme of things, the statements of the text-book, the charts, plans, and outlines that constitute the paraphernalia of an industrious pedagogy, may entirely fail to elicit judgment for lack of comprehension on the part of the pupil. There is no short-cut to true learning whereby the learner can

master a subject without passing through the stages of reasoning which define the subject, give it its direction, and develop the scale of its articulation. To the learner, each step in this scale must be judged for itself, until the scale is complete. Charts, plans, and outlines are important aids to teaching when, but only when, they register for the pupil the results of his own judgments at the level at which these judgments are being made. As a complete scheme, offered to the pupil before he is able to comprehend the steps by which the scheme was developed, such a method puts too high a premium upon the early acquisition of habits of rote-memory. What we remember is, to be sure, a form, but it can be the form of the scheme, or the words of the teacher, rather than the form of the subject, which the scheme, or the words, are intended to express.

Judgment, then, is not the basis of reasoning, because there are stages of reasoning that precede judgment; yet without reason there can be no judgment, and with the aid of judgment we can also think. In thought we reflect, employing the tools of reflection which are the signs and symbols that represent essential aspects of the configurations of behavior. These essential aspects are the various scales of articulation with which we measure and define the structure of configurations. Thinking is reasoning with words and numbers, with gestures and symbols—in brief, with surrogates which, while they have the disadvantage of being artifacts, have the immense advantage of bringing together common aspects of different figures and putting

them in orderly arrangement for application to varied and varying events.

In order to teach thinking we must teach the art of reflection; but in order to teach reflection and the cultivation of leisure in an active workaday world, we must stimulate a curiosity concerning the scale of articulation of things. The way things go together and come apart depends upon principles of order, an understanding of which requires the employment of reflective thought. Thus, we proceed from the orderliness of nature as it is revealed in perception, to the principles of this orderliness which can themselves be mastered and handled only by the abstract methods of thinking.

CHAPTER XVII

THE MEASUREMENT OF INTELLIGENCE

§ 73. *The Empirical Character of Mental Tests*

During recent years there has been developed a new branch of psychological science popularly known as "mental testing." Impelled by the practical motive of placing an individual in relation to his fellows with respect to mental capacity and attainment, these mental tests have come to be widely employed. Although the trustworthiness of the tests has often been questioned, their administration has been greatly extended, and they are now generally accepted as the best means we have of predicting an individual's capacity to perform certain types of work.

Beginning in the schools, where examination is constantly required in order to determine the grade of study appropriate to an individual pupil, the tests have been extensively used with backward children and adults as a means of measuring the grade of feeble-mindedness to which they belong. While the school still furnishes the largest field for mental measurements, tests are now being employed as a check upon the capacity of college students to profit by a higher education, and as a means of sorting large groups of men—for instance, those drafted or enlisted for public service, as soldiers, sailors, and guardians of the peace. In addition, tests are also coming to be widely used

as means of selecting men for specialized employment, the general test of intelligence being supplemented by a test of fitness to undertake the special work required of the employed.

The method by which the tests have been constructed is mainly that of common sense. Alfred Binet, the French psychologist, who was chiefly responsible for the tests known as the Binet-Simon scale, secured his materials for measuring the "mental age" of children by asking experienced teachers what they could expect in the way of intelligent achievement on the part of the average child of a certain age. Having this information before him, he drew up a set of questions with which he examined a large number of school children of that age. The questions, or tests, afterwards selected from the list as appropriate to this age were those that could be answered by seventy-five per cent of the children examined. By gradual experimentation he was able to make up a standard set of tests for children of each age. The tests were so graded that approximately twenty-five per cent of the children would fail; whereas of the seventy-five per cent who passed, twenty-five per cent would be able to answer not only all the test-questions of their age-group, but also some of the tests in the next higher group. It was Binet's practice to attribute to a child the mental age indicated by the highest group of tests in the scale which the child was able to solve completely.

The translation of the French tests into English, and their application to American children, indicated that, while

fairly trustworthy, the earlier tests from three to six years were too easy, while the later tests from eleven to fourteen-sixteen (which is a single test) were too hard. Accordingly, several revisions of the Binet scale have been undertaken; of these the best known and most widely used is the so-called Stanford Revision made by L. M. Terman of Stanford University.[1] As a result of his revision, Terman has given us a scale having six tests in each age-group. He has also revised Binet's method of scoring so as to allow a credit of two months for every test correctly solved, irrespective of its position in the scale. By this modification Terman combines the Binet method of testing with another, called the Point-Scale method, in which a large number of tests is administered indiscriminately, and the individual is rated by his total score of right answers.

Terman, however, retains the graded age-groups, so that his tests are administered in order, beginning with the earlier and easier tests, and proceeding through later and more difficult age-groups. In practice one begins with an age-group that would seem appropriate to the child, and if the questions are answered correctly, one proceeds to the next higher group, assuming the child's capacity to answer all the questions that have been passed over in lower groups. The child is then given a credit of two months in mental age for each question he answers correctly in the higher groups, and a similar credit for all the tests belonging to the age-groups below the level at which the examination

[1] Cf. L. M. Terman, *The Measurement of Intelligence* (1916).

began. This assumed credit also includes the years of infancy for which there are no tests in the scale. Accordingly, a child of twelve who answers correctly all the tests of the twelve-year group, and in addition three tests of the thirteen-year group, would be credited with 150 months, or twelve and one-half years in mental age.

Following a suggestion of William Stern, the score made in the tests is related to the chronological age in months, and the ratio of the two is then called the "intelligence quotient," or IQ. The IQ of the child referred to above would then be 1.04, or, disregarding decimals, 104. Terman finds—indeed he has shaped his tests in order to secure—a "normal" distribution of IQs in which approximately sixty per cent of an unselected group of children will have IQs varying from 90 to 110. These children he calls "normal." About fifteen per cent who have IQs of 110 to 120 he designates as having "superior intelligence"; and an equal per cent ranging from 80 to 90 he calls "dull." Above 120, he finds that about three per cent will range upwards to 140, and these children he describes as of "very superior intelligence"; two per cent will go beyond 140, and these he calls "near genius." Below 80, he finds about three per cent of "border-line" cases with IQs of 70 to 80; and, finally, two per cent lower than 70, which he classes as "feeble-minded."

If the examination has been carefully made, the IQ has a high predictive value. Re-examination at a later time shows that the IQ remains fairly constant; even after a

period of years the same child will generally yield an IQ that varies only a few points from the one first recorded. This fact, more than any other, has given weight to the contention that the tests measure something inherent and unchanging in the mental make-up of the individual. Just what this something is, and how significant it may be for the individual's career in life, are matters presently to be considered.

Regarding the technique of testing we shall have little more to say, for not only are writings upon the subject extensive and readily accessible, but the statistical treatment of the results requires a special study that would carry us beyond the scope of this book.[1] Our brief survey of the Binet scale, and the Stanford revision of it, is intended merely to present the subject, in order that we may now raise the question what the tests test, and what insight they give into the nature of intelligence.

§ 74. *Critique of the Tests*

It is obvious from what has been stated regarding the origin of the Binet scale that the questions included in these tests are largely empirical in character; that is to say, the method of their selection has been that of "try and fit" without the guidance of any special scientific knowledge. If it be true that the average six-year-old child can dis-

[1] Among recent books the following may be mentioned: Rudolf Pintner, *Intelligence Testing* (1924); L. M. Terman, *The Intelligence of School Children* (1919); V. E. Dickson, *Mental Tests and the Schoolroom Teacher* (1925); H. C. Link, *Employment Psychology* (1919); J. C. Chapman, *Trade Tests* (1921); C. W. Odell, *Educational Statistics* (1925).

tinguish morning from afternoon, whereas a five-year-old child cannot, this is an empirical fact. But it is not a scientific fact; because the distinction involves elaborate configurations of behavior, the range of which, at the ages mentioned, we know nothing about. The distinction called for in this test, taken from the Binet scale, is only a symptom of mental development, just as fever may be a symptom of disease; but whereas fever is a definite condition, of which we know something, the distinguishing of morning from afternoon appears to belong to a large cognitive group of oppositions, any one of which would be equally valid as a test of intelligence, though some of them might be expected to be much more precise and fundamental than others.

Studies of intelligence, aiming to find out the fundamental patterns of delineation, which has been previously referred to as the criterion of intelligence (p. 263), have scarcely been planned, much less undertaken. Instead, we are still measuring intelligence with the vaguest of empirical means. What the tests test we do not know. Their validity rests entirely upon the correlation of the scores attained in the tests with other criteria, such as school-grades, teachers' estimates, and degrees of success or failure in various tasks of everyday life. In effect, what we are measuring is public opinion of intellectual efficiency in terms of a standard set of tests derived from common-sense estimates of what intelligence should be able to accomplish at different age-levels. The chief value of the tests lies in their standard-

ized procedure. At least they are free from individual bias, although they do not escape the errors of group or conventional opinion. When properly administered, they provide a uniform type of examination, the results of which are directly comparable with the results of similar tests administered at different times and places upon different individuals or groups. This value is real, though limited. It is real in that it is not subject to individual variation in scoring, which is so disturbing a factor in the content-examinations of the school, even when these are uniform. The answers to the tests are usually so devised that the scoring is either "right" or "wrong." But the value is limited; for, remembering the discussion of testimony (pp. 231 f.), we cannot fail to realize that suggestive influences are always at work in "either-or" questions, where the chance of hitting upon the right answer is even. With a large number of such questions, the probability of making a high score by chance alone is, of course, very remote; nevertheless the promptings of suggestion are felt by the person being tested, and of a particular question we can never be sure whether the person knew the answer or guessed it.

Although not all test-problems are of the "either-or" variety, the score is always minus whenever any part of the answer is wrong, no allowance being made for the quality of the answer. One of the questions of the Binet adult-test is to give three differences between a President and a King. In this case one statement of a single difference might indicate a greater intelligence than another state-

ment of three; and yet, the former would be "wrong," and the latter might be "right."

It is a real advantage to possess a standardized procedure of examination, but the advantage is very limited when we do not know precisely what we are examining. The statistical treatment of results, necessary under these conditions, masks many distinctions that may be highly pertinent to the individual tested. Furthermore, the tests that have thus far been devised furnish little or no insight into the psychology of intelligence and mental efficiency, and they assume, but do not define, the mental levels with which they deal. By recourse to the "probability curve" a normal distribution is assumed for the traits that constitute "mentality." These traits, whatever they may be when taken separately, are all pooled in the tests. The results obtained from a large number of cases are expected to show all degrees of variability about a central group which itself varies only slightly; but the mental traits themselves remain hidden in the IQ.

As we have seen in the case of Terman's revision of the Binet scale, tests were sought which would secure approximately sixty per cent of IQs with a variation from 90 to 110, twenty per cent ranging above this norm, and twenty per cent below. While this procedure is sound enough, a test that will produce such a distribution is a test of intelligence only in so far as the individuals thus distributed are otherwise known to possess the degrees of intelligence to which their test-scores entitle them. A test which simply measured

height or weight would also give a normal distribution curve; but it would have little or no correlation with intelligence. Until we possess a more accurate knowledge of what intelligence is, our tests are only a means of comparing one set of empirical data with another.

Imperfect though they are, the tests are a useful means of rating individuals. They have the advantage of a certain exactness; furthermore, the common-sense criteria employed in devising the problems and questions are seldom without value, even though they leave much to be desired in the way of critical insight. The next step to be taken in mental measurement is the investigation of these criteria in order that normal patterns of reasoning and thinking may be established. With these as models, tests can then be devised to show whether or not an individual knows and can employ critical patterns of behavior under test conditions.

§ 75. *Physiological Development*

It is not enough, however, to compare the scores obtained from the tests with the chronological age of the person tested. Binet was led into this error when he applied his scale to feeble-minded adults, and assigned to them the mental ages of childhood. While a comparison of this sort is not without a certain significance, the effects of bodily maturation cannot be overlooked, for an adult is never quite like a child, and "arrested" mental development can never mean that a mind which has ceased to grow in a mature body is like a normally growing mind

in an immature body. This and other considerations have shown the necessity of determining both the *physiological* and the *anatomical* age as correlates of mental age. While in general it is true that bodily and mental maturity go hand in hand, the rate and the tempo of growth greatly vary from individual to individual. During the period of growth and maturation, it has been found that those who grow rapidly in body grow with corresponding rapidity in mind, while those slow in bodily growth are also slow in mental growth. The common idea that rapid growth of the mind is often at the expense of bodily growth, and *vice versa*, so that bright children are apt to be physically undergrown, and overgrown children are apt to be dull, is not at all borne out by the results of investigation.[1]

The tempo of growth is also an important consideration. In some children the period of adolescence is of brief duration; in others it is long drawn out. Accordingly, the IQ stands in need of correction with reference to the child's physiological and anatomical age. For instance, a child of eight might test at six years; this would give him an IQ of 75 which, according to Terman, indicates a "border-line" case. But if a physiological examination should reveal a corresponding retardation in bodily growth and development it would be unsafe to predict low-grade intelligence as a permanent characteristic; because the tempo of development might be unusually slow in this child, and yet in time

[1] Cf. Bird T. Baldwin, *Physical Growth and School Progress* (U. S. Government Printing Office, 1914).

he might mature as a normal adult. Similarly, an eight-year-old child who tests at ten is not necessarily destined to possess in adulthood the intellectual distinction which his IQ of 125 would indicate. If his bodily development should be found already that of a ten-year-old child, we should be inclined to discount this indication of precocity. Indeed, there is some evidence in support of the statement that those children who mature at an early age, and pass through the period of adolescence in a relatively brief space of time, are at a disadvantage, despite the mental quickening that accompanies their rapid growth. There simply is not enough time in which to make all the adjustments to life that an adolescent must make. Consequently, if they are "bright" children, they may show startling signs of genius, and even pass through school and college at an extraordinarily early age, only to flatten out in adulthood and become quite commonplace personages. If they are "dull" children, they are a still more serious problem to society; for they mature before they can know enough to get properly adjusted in the world. The criminal and delinquent types are said to be largely supplied from this class.

The investigation of these correlations of mental and bodily growth is only at its beginning. Before we can speak with any authority upon the subject, we must await the results of experiments, some of which are now in progress, that will trace the same individuals throughout the course of childhood to maturity. One of the investigators

in this field, Professor W. F. Dearborn, makes the following cautious statement of the evidence at hand:

Our present opinion, which may or may not be substantiated, but which is based on repeated observations on a relatively small number of individuals, is that we shall find the following conditions: A child somewhat backward in mental development, whose yearly increments in mental age have been small, and who on repeated examination proves to be correspondingly backward in general physiological development, may frequently make up for his slow start before he reaches maturity. The prognosis in his case would be better than in the case of a child of the same early mental level but who, at the same time, is found to be physiologically well along in the course of development. The fact that he has come on so well in general physical development in the early years without corresponding mental growth would make his prospects less hopeful. Similarly, some of our much heralded prodigies, who have rather petered out in later years, may prove to have maintained their relative superiority for a few years because of early maturing, supplemented by a kind of hot-housing.[1]

The means of supplying these physiological corrections to the test-scores are measurements of height, weight, and expansion of chest; and, for more definite evidence of maturation, the eruption of the teeth, the onset of puberty, and the rate of ossification indicated by X-ray examination of the bones of the body. In this way scales of normal bodily growth are determined, which can be applied to an individual of a given age in order to show to what extent he varies from the norm of a person of his general build and stature.

[1] Cf. "The Development of the Intellect in Childhood and Youth," in *The Child: His Nature and His Needs* (1924), p. 85.

§ 76. *Performance Tests*

But the mental tests of children stand in need of more than correlation with bodily growth; for there are other forms of intelligence than those that presuppose a knowledge of words, numbers, and symbols. We have already emphasized the facts of intelligence in perception, and have seen that the acquisition of skill, far from being a mere routine, is the formulation of the most appropriate means to an end. Practical efficiency is always implied in some measure in intellectual efficiency; because thinking rests upon reasoning, and reasoning has its roots in perception. But although perception is fundamentally an act of behavior, it by no means follows that a person of high-grade practical efficiency will be correspondingly efficient in his ideational undertakings, or the reverse. While a commonly enjoyed schooling teaches all who are not feeble-minded to employ words and numbers with some degree of proficiency, it would be wrong to suppose that a test given in these terms will ever be an adequate measure of the intelligence of one whose proficiency is greatest in practical behavior. "Performance tests" have accordingly been devised to meet this shortcoming of the mental tests. These tests always provide a situation to be handled by perception rather than by reflection. A simple performance test for children is the form-board which has depressions of different shapes into which corresponding solids can be fitted. More elaborate performance tests call for greater ingenuity, and also greater skill, in fitting things together. We may include under this

heading many "trade-tests," which attempt to diagnose the constructive intelligence required in various skilled and unskilled trades.

As yet the performance tests suffer from the same limitations that beset the mental tests. The fundamental configurations of perception are not well enough known to serve as models, and the tests have therefore been dictated by crude empirical data and by guesswork. We have here a promising field of investigation which may be expected to yield valuable results without too great an expenditure of time and effort. As a result of his experiments, Köhler was able to devise a very satisfactory test for the intelligence of apes in his "detour-board" (see p. 275). Similar studies upon the perceptions of children might lead to performance tests definitely calculated to measure degrees of perception and skill, the configurations of which could be comprehended and described in a scientific manner not at present possible.[1]

§ 77. *Social Efficiency*

In addition to perceptual efficiency, social efficiency is inadequately measured by the tests now in use. Our study of instinct revealed the fact that social behavior is not attributable to the several individuals who mix with and respond to one another. On the contrary, sociability depends upon a "membership-character" of the individual, determined by the group to which the individual belongs.

[1] An attempt of this sort by O. Lipmann and H. Bogen is described in a monograph entitled *Naïve Physik* (1923).

Consequently, none of the individual tests, whether mental, physical, or performance, is calculated to reveal responsiveness to social situations.

We all realize that social responsiveness is one of the important features of human efficiency; its presence will do much to overcome a serious handicap of mental, physical, or practical deficiency, while its absence can render nugatory the most brilliant mind or the most skillful body. At present we have no satisfactory means of measuring propensities for communism or leadership, for group-cohesion or anarchy, although these propensities, working in and through individual mentality, physique, and skill, are the determining qualities of citizenship.

It would, however, be wrong to suppose that sociability is merely added to the rest of an individual's traits—that an individual is what he is, even before his social traits are considered. On the contrary, individuality is a product of society; at least it is a product of some larger whole, the members of which must be individuated before they can become independent. "Larger wholes" are always vague and inarticulate; and while they possess a certain particularity from the outset, what we call individuality accrues to them only as a result of the combined processes of differentiation and integration. In the case of *amblystoma*, cited in an earlier connection (p. 23), the individuality of this salamander was greater in maturity than it was in the embryonic state; although the animal possessed particularity from the outset.

So it is in the case of a social group; the cohesion of its members may be loose or firm. Lack of cohesion in a group may attend either a low or a high degree of individuality on the part of its members. The individuality of a school of fish is relatively low, and likewise that of its several members. But the individuality of a casual group of persons crowding into a subway-train is also low, although the individuality of its separate members, each intent upon his own destination, is very high. On the other hand, whenever the cohesion of a group is firm, the individuation of its members must be relatively high; because without differentiation there can be no high degree of integration. And yet, even here there are marked differences between the behavior of the individual members of a communistic organization, and the members of an organization under leadership. A crowd without a leader is swayed by its rhythm. The individual members contribute no directing influence; instead, they intuit their several necessities through suggestion and sympathy, without reflection and without insight. Under leadership, the group is differently organized; each member is now focused upon the leader, and while intuition is still the chief method of communication from member to member, the group moves towards its objective with constant reference to the leader's direction. Consequently, each participating member is enlightened by the leadership that guides him; and he may even exercise a certain amount of reflection without relinquishing his participation.

Membership in a group is not determined by the group alone; for powerful and essential as this influence may be, the members also contribute to the integration which their differentiation makes possible. The organization of a school of fish is one thing, and the organization of a crowd of men is another. While both "schooling" and "crowding" are inevitable products of *togetherness*, the mere juxtaposition of like individuals leads to different kinds of groups —loose and firm, centralized and decentralized—according to the several influences exerted by the individuals that are thus thrown together. Nor should we suppose that these individual influences are altogether involuntary, as they appear to be in the limiting case of sheer communism. Volition itself is but a differentiation of behavior which has a high degree of integration as its goal. Consequently, we have a will to belong as well as a will to separate; and we can make a voluntary, as well as an involuntary, surrender of our individuality to the group.

Social behavior is not a thing apart from individual behavior; it is a factor in every individual action. Prior to social action there is no individual action, but only particular acts. These acts may be directed, as they are in the impulses, instincts, and reflexes, or they may be relatively aimless; but whenever they become individualized they also become socialized. Even those individualized activities which, superficially, appear to have no social implications whatever have their setting in a social world. They do not stand naturally by themselves, even though they may acquire

an artificial remoteness. A skilled craftsman or an artist may think that he works only for the joy of the doing, and that his criteria of judgment are entirely his own; but his enjoyment derives, nevertheless, from his social being; for without a social perspective his forms could not have taken shape, and without an ideal audience he would have no criteria by which to judge his own workmanship. The artist creates his audience as he works; and although he may find little kinship between it and the actual auditors and spectators who view his pieces, he is nevertheless group-minded, even when the group to which he fancies himself belonging is that of God and the Archangels.

A social influence is present in every individual test of intelligence; but the conditions of examination may nullify its significant effects; furthermore, many tests are so artificial that their social implications are quite ambiguous. What we need are tests with a clearer social implication, that will show us whether the person tested does, or does not, work readily with his fellows. Is he docile and submissive, or assertive and masterful; and what are the qualities of his social demeanor? The same person will behave, now in one way, now in another, according to the social conditions in which he finds himself.

In a previous section the social behavior of hens in a poultry-yard was described (see pp. 86 f.). According to the investigation there reported, the members of a flock work out a definite hierarchy of despotic domination; but our observer also reports that whereas the despot of the flock

maintains her reign with an easy and good-natured superiority, the hens that are most picked upon in the group are also the most cruel in the treatment they accord to the few that fall below them in rank-order. It thus appears that the restraint exercised from above becomes more and more oppressive as one passes downwards to the underlings. Instead of becoming mild and subservient, those who find themselves "clutched in the fell circumstance of chance" at the bottom of the ladder are resentful.

This state of affairs has its parallel in human society; for though oppression is partly attributable to natural submissiveness, it is not conducive to docility. The fringe of egotists that surrounds society is largely made up of persons who resent oppression. Lacking, however, the fundamental force of physical strength and instinctive mastery, or the adventitious aid of a traditional prestige lent by age or family connection, they build up an "inferiority complex" which enables them to cover their weakness with a show of strength. Without a natural dominance which commands respect, they attempt to create an artificial dominance by advocating war against the rulers of society in the interest of the downtrodden. The paradox of a society led by those naturally unfitted to be leaders is evinced in all revolutionary movements; and the cruel and high-handed methods employed in times of social upheaval are attributable to the same resentment that causes a much picked-upon pullet to be unnecessarily cruel in her treatment of those beneath her in the rank-order of the flock.

It is apparent from so obvious a parallel as this one between hens and men that expressions of group-behavior are apt to be far too complex to be forthwith tested and employed in a prediction of social intelligence. Yet we cannot close our eyes to the group-mindedness of the individuals whose intelligence we do make bold to estimate. One thing is certain: "a healthy mind in a healthy body" is not the sole consideration in predicting a safe career through life; for without reference to the social setting of both mind and body we shall be giving but a partial, and perhaps an erroneous, estimate of what the individual is capable of doing.

§ 78. *The Concept of Intelligence*

If our concept of intelligence is to embrace these different aspects of development, we must find a means to plot the course of behavior which includes them all. As a scientific method of approach we might do well to adopt the genetic procedure employed by Köhler in his study of the chimpanzee. This would mean working out the patterns of behavior naturally employed in overcoming obstacles by the achievement of detours. Patterns of behavior with an individual or with a social emphasis, when correlated with bodily capacities incident to maturation and growth, could be made to serve as a basis of measurement by varying the pattern in a definite and perspicuous manner. This requirement has been satisfied by Köhler in his "detour-board" test (see p. 275); it is likewise satisfied in some of the tests now employed with human beings.

In principle, a test of this order, in which "degrees" of intelligence are indicated by degrees of attainment, is usually more significant than a test of the "right-wrong" variety; but not always, for if a "right-wrong" test is perspicuous and capable of definition—as it is, for instance, when Figure 13B on page 264 is seen as a shield—the problem becomes one that must be solved, and cannot be guessed. What the range of such tests would be, and how well calculated they are to predict general intelligence, we cannot yet say. In all probability tests of this type will prove less useful than those that require a definition of perception under variable conditions of difficulty.

The scheme we advocate in the construction of mental tests would follow the four main types of learning, namely, 1) *differentiation*, 2) *assimilation*, 3) *gradation*, and 4) *redefinition* (cf. pp. 244 f.). Each of these processes can be tested at different levels of development by tests of varying difficulty. 1. For instance, the capacity to differentiate a right from a left turn in the T-shaped maze can be elaborated to include a succession of turns, right and left, which will constitute a more complicated and more difficult maze. Tests of discernment, both perceptual and ideational, are readily contrived: as, for example, the familiar test in the newspaper Sunday-supplement, entitled "What's Wrong with This Picture?" requiring one to find some irrelevant feature of the drawing. 2. Capacity of assimilation furnishes the basis for another type of test. Can the person tested put together what he already knows and can do

separately? And with what degree of success does he achieve the new whole which the combination warrants? Tests of ingenuity fall under this heading; but we can also test previous achievements by bringing into juxtaposition things that will continue to stand apart unless the individual has already learned to put them together. Finding the connection and "sense" of a scrambled sentence is a test of assimilation; and so is the well-known "completion test," in which certain gaps in sentences or in pictures must be filled with appropriate words or features. 3. The capacity of gradation offers numerous opportunities for tests ranging from simple opposition and direction, to complicated scales of steps in varying sequences. The "opposites" test, in which a list of words is given for each of which the opposite is required, is one example; "following directions," in which the person tested is required to do certain things in a certain order, is another. A third example is the completion of a series of numbers by repeating a pattern that varies increasingly in difficulty; thus:

15	—	25	30	—	40	45
98	87	76	65	—	—	
24	18	13	—	6	—	
18	6	36	—	—	48	

A fourth example is the test of slightly varying weights, all of the same appearance, which must be arranged in a series from lighter to heavier. 4. The capacity of re-definition can be tested by equivocal groupings of dots and lines, or of beats and tones; by sentences with double meaning;

and by performance-tests calculated to show whether or not an individual can employ an act that belongs to one situation in another and different situation.

Those familiar with the tests commonly employed will note that all the examples given above have been selected from this source. But "testers" do not always realize what they are testing, and many of the tests now used mix different types of delineation. What we are advocating is an analysis of the tests in terms of the four chief types of learning, and also an investigation of the essential forms of apprehension and behavior in which these types express themselves. We should then have scientific guidance in the construction of tests, and at the same time we should know what it is we are testing. In the selection of materials for a test care must be taken that the degrees of difficulty are inherent to the task that is set, and not merely in the logic of the one who devises the test; for unless we know where the difficulties lie we can gain no insight into the intelligence necessary to overcome them. The test will then remain only a means of discovering "symptoms" of intelligence.

We have far to go before all these shortcomings can be fully corrected; but at least a start can be made now that we have before us the illuminating study of Köhler upon the mentality of apes.[1] If we will but put ourselves as sympathetically in touch with the mentality of our children as Kohler has with his chimpanzees, we shall find an abundance

[1] Cf. *op. cit.*

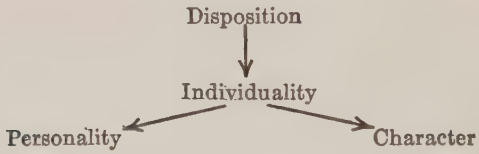
of normal configurations, both individual and social, working their ways out to completion. A test of intelligence is a test of progress and achievement in the delineation of these normal patterns. What we require is greater knowledge concerning the essential course of behavior, and the expressions thereof which have the most significant and wide-reaching effect upon conduct.

§ 79. *Personality and Character*

In applying the concept of intelligence to the "whole man," as we must do in order to make an adequate appraisal of his capacity and ability, we should have in mind the true nature of individuality and its expressions. Broadly speaking, individuality has its roots in psychophysical dispositions, both inherited and acquired. The educational influence of experience molds these dispositions in countless ways. As a result, individuality manifests itself in modes of dependency upon the group to which the individual belongs, and also in modes of independence. While every individual possesses both these traits, some individuals are, on the whole, more docile than others. But docility and assertiveness express themselves in many different ways, so that under one set of circumstances an individual will be docile and under another set of circumstances he will be assertive. Furthermore, the circumstances that occasion this variability are not alone the external conditions of behavior, but also the internal conditions of inherited and acquired dispositions. What we term "individual differ-

ences" are therefore very complex, with inheritance, acquisition, and environment all serving as determinants.

In addition to assertive and submissive behavior, a human being expresses individuality in two other ways, which we may call *personality* and *character*. In a simple schematic form we can derive individuality from disposition, and, in turn, personality and character from individuality:



Personality is the expression of a man's "inner" life; while character is the expression of what he does or achieves. In describing degrees of personality we are apt to employ such words as "richness" and "fullness," whereas character is described in terms of "will-power" and "persistence."

Again, as in the case of assertiveness and submission, personality and character are aspects of the same individuality, although under different circumstances they express themselves in many different ways. But the one may dominate the other; for a rich personality is not necessarily associated with a strong character, nor is colorless personality necessarily coupled with a weak character. The furnishings of an individual's "inner" life can be rich and varied, while the impulse to overt action and achievement may be slight. Such a personality may assume the attitude of a spectator in the world, and, like Meredith's

sentimentalist, "seek to enjoy without incurring the immense debtorship for a thing done" (see p. 157). On the other hand, a strong and efficient actor in life may be little concerned with his own mentality, although he is keenly perceptive whenever the occasion demands decisive action.

The first type is not necessarily sentimental, for it includes artists, poets, and philosophers, who express their individuality in symbolic forms which inspire the masses of humanity and lead them in the onward march of civilization. Neither is the second type confined to the opportunist, who, without cultivating his leisure, reaches his decisions on the spur of the moment, and trusts to suggestion and a ready technique to carry him through. Many highly important undertakings of life can be pursued only at a leisurely pace after much careful planning. Reflection and the subtle employment of representative forms of expression are indispensable to statesmanship and to business enterprise, as well as to artistic endeavors and all theoretical pursuits. On the other hand, there are numerous undertakings which demand a readiness to decide an issue and take action without reflection. Genius expresses itself both in personality and character. Great writers, great artists, and great thinkers are apt to have a surplus of personality, which lends to their undertakings a richness of design that only a wealth of representative forms of expression makes possible. Great leaders of men in action—generals of armies, captains of industry—and also inventors and technicians, must rely upon perception more largely than upon reflection. Yet the

genius of character is no less real than that of personality. To be able to make "the secret thing discourse to the brain by weight and balance," as Meredith says (see p. 214), is no less an achievement than to be able to give over one's leisure to reflective planning and to an effective organization of one's materials of thought.

While the extreme expressions of personality and character may have little in common, the middle ground occupied by most men calls for an individuality which is both reflective and perceptive. Without a capacity for reflection and a constant enrichment of one's inner life, the pauses between active undertakings will be empty of significant content. In youth one may resort to the refreshment of sleep, and thus renew one's strength for the vigorous ordeal of the day's work; but as old age approaches the incitements to action are dulled, and the routine becomes oppressive. There is no more pitiful figure than that of the retired business man seeking to enjoy the wealth he has amassed without the intellectual resources which alone make leisure enjoyable.

But unhappiness is associated also with the career of a personality which avoids the issues of character; for indecision weakens moral stamina, and one falls readily into melancholy brooding. If one dwells too much upon the patterns of events as they shape themselves, one ceases to care about the outcome. A person who withdraws from the events of life and assumes the rôle of a passive spectator loses contact with real issues, and at length finds himself

remote and alone, unsought by others, and regarded as unimportant in their affairs. This loneliness breeds melancholy, or worse; for without participation in the affairs of one's fellows the sense of "we-ness" is lost, which may bring in its train the symptoms of paranoia.[1] So fundamental is the gregariousness of man that without participation in group-life he imagines others arrayed against him. In the degree in which he fails to enter into sympathetic contact with his fellows, he becomes suspicious; and suspicion leads him to believe that others are conspiring against him.

While these minor symptoms of paranoia may be far removed from the actual disease, they are nevertheless highly significant factors in social life. It would hardly be an exaggeration to say that no person goes through life without from time to time suspecting machinations on the part of persons with whom he does not happen to share intimate relations. Since it is only on terms of intimacy that personality finds a means of expression, without an audience, small or large, real or ideal, to which one can pour forth one's hidden secrets, the mind is pent up in its own stifling atmosphere. Under these conditions, modes of expression are devised which lead the inclosed spirit to take measures for defense against a fancied social opposition. It is then that a true paranoia manifests itself in elaborate methods to overcome and circumvent these antagonistic forces. The great power of the confessional,

[1] Cf. Heinrich Schulte, "Versuch einer Theorie der paranoischen Eigenbeziehung und Wahnbildung," *Psychologische Forschung*, 1924, *5*, pp. 1 f.

and the undoubted relief that comes from sympathetic methods of treating mental ailments, arise in breaking down the barriers that have been erected between a personality and the social world to which it rightfully belongs.

Thus personality can never afford to lose its contact with character; and a sound education will guard equally against either self-centered remoteness from the issues of life, or engrossment in active participation in affairs at the expense of cultivating leisure. In order to develop both personality and character it is necessary to view intelligence as a product of both taken together. When the contours of reflection and perception are clearly drawn, one has the requisite insight into his own life and his relations with others; and hence he can act clearly and decisively when the time comes for action, and also can reflect and weigh issues, and contemplate and enjoy the configurations of mind, when the time is appropriate for thinking and appreciating. While individual differences are numerous and deep-seated, thought and action have a common source. If, as teachers, we can understand how thought and action are related, we shall be able to provide means for their proper expression in the course of education. It is for this reason that the science of psychology looms so large upon the horizon of educational practice; for without knowing our children as they are in their own individual and group lives, we shall be unable to give them more than a bungling and often a mistaken aid in the pursuit of their education. The instinctive nature of man, the perception of the events of life, the memory of and

the reflection upon the past, the anticipation of the future in representative forms, the varied modes of learning, and the estimates of intelligence based upon the achievement of new tasks—these are the major problems of psychology which underlie the plan and method of education.

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